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A FACTORIAL STUDY OF PHYSICAL CONSTITUTION IN WOMEN.

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INTRODUCTION.

THE assessment of body build as an integral part of the total personality is now accepted as an important procedure in the practice of clinical psychiatry. Body build has been found to influence symptomatology, mental status, course and prognosis in neurotic and psychotic disorders (Betz, 1942; Mauz, 1930; Kisselew, 1931; Freudenberg, 1941; Rees, 1945, 1947). Whereas the delineation of physical types has now become an objective procedure by the use of anthropometric indices (Rees, 1949), it has long been recognized that the differentiation of physical types in women is much more difficult. Kretschmer (1921) pointed out that the types of physique described by him were less easily diagnosed in women, and Sheldon (1940) pays comparatively little attention to the variations of female body build.

These difficulties are partly related to anthropometric sex differences, particularly pelvic development, but are mainly due to the fact that scientifically satisfactory analytic procedures have only recently been applied to the study of body build.

The study of body build (somatology) has its roots in antiquity. Hippocrates described two main types of body build, a broad type, the habitus apoplecticus, and a narrow type, the habitus phthisicus, with alleged specific disease susceptibilities as indicated by the names. Galen described various types of body build with particular temperaments which were considered to be determined by various mixtures of the four humours, blood, phlegm, black and yellow bile. The ancient physicians, in fact, appear to have paid more attention to the man as a whole than modern medical practice.

During the past century a great variety of classifications of body build have appeared. The criteria used for categorization differed widely, e.g., morphological concepts governed the classifications of Manoeuvrier (1902), Brugsch (1931), Stockard (1923), and Aschner (1924). Physiological features were emphasized by Rostan (1828), Carus (1852) and Sigaud (1914). Develop-

mental attributes formed the basis of the classifications of Viola (1933) and Sheldon (1940), whereas disease susceptibility was the primary basis of the classifications of Beneke (1878) and Draper (1925).

The majority of the above classifications do not have a scientific basis, and as a rule an inductive approach is lacking.

The fundamental problem of somatology is the determination of the nature of variations in body architecture and the factors underlying such variations. The solution of the problem clearly calls for an inductive approach.

The appropriate method for attacking the problem would be to carry out detailed anthropometric measurements on a random sample of the population, and from the data to determine the nature of the variations and to discover the most scientifically valid and useful way in which the complex variations in body build can be described.

Factorial analysis is a statistical method which is suitable for application to the study of variation in body build, and constitutes a satisfactory objective inductive method of analysis. Factorial analysis was first used in the field of body build by Burt (1938) and subsequently by his pupils Cohen (1938, 1940 and 1941) and Hammond (1942).

Rees and Eysenck (1945) found factorial analysis valuable for determining the nature of variations in physique in a group of 200 male neurotics, and were able to utilize the results in computing an index for studies on physical and personality correlates (Rees, 1944, 1945, 1947).

In view of the fruitful application of factorial analysis to the study of body build in soldiers suffering from neurosis, it was decided to apply the method to the study of physical constitution in women. Accordingly, a factorial analysis was carried out on physical measurements of a group of 200 women service patients with the object of determining—

- (1) The factors underlying the variations in female body build.
- (2) The most useful, understandable and economical way of describing such variations.
- (3) Whether physical types in the sense of mutually exclusive categories existed.
- (4) The most useful objective method of assessing body build for clinical investigation and research.

EXPERIMENTAL POPULATION.

The experimental population consists of 400 female service patients, suffering from neurosis, successively admitted to Mill Hill Emergency Hospital. The majority were members of the A.T.S., with some members of the W.A.A.F. and a small number of women of the W.R.N.S. The mean age was 25.01, standard deviation 5.53.

METHODOLOGY.

The following anthropometric measurements were taken according to the standardized procedure described by Hrdlicka (1939), Martin (1928) and Wilder (1920); stature, suprasternal height, symphysis height; breadth and length

of skull; biacromial diameter, transverse chest diameter; sagittal chest diameter; bicristal diameter; length of sternum; length of arm; chest circumference at full inspiration and full expiration; hip circumference and weight.

Each of the fifteen variables was correlated with the others by means of the tetrachoric method. The matrix of intercorrelations was analysed by Burt's (1941) summation method.

The primary assumption in factor analysis is that when two traits are correlated they can be regarded as being dependent on a common factor. The aim of the analysis is to determine the factors responsible for the intercorrelations of physical measurements. The first step is to determine whether there is a single significant source of variation influencing all the traits in the matrix, i.e., a first common factor of the intercorrelations. The next step is to discover whether other factors exist to account for any residual correlations after the effect of the first common factor is removed. Thus, if it is shown that certain traits tend to cohere in groups, it would be possible to divide the population into types according to the predominance of one or other groups of traits in the individual's physique.

ANTHROPOMETRIC SEX DIFFERENCES.

It was noted above that at least part of the difficulty in delineating physical types in women was in anthropometric sex differences. It would therefore be of interest to consider the nature and extent of such differences before proceeding to deal with the results of factor analysis.

Table I gives the means and standard deviations of our group of 200 female neurosis patients, together with similar data on groups of neurotic and normal soldiers studied by the author (Rees, 1943). It will be seen that the mean age of the female group is approximately four years less than that of the male groups. While this would not vitiate comparison in skeletal anthropometric dimensions, since skeletal growth would have ceased in all groups, it would, together with the possibility that the groups are not strictly comparable in socio-economic status and other factors, make a detailed statistical comparison inappropriate.

Inspection of the data in Table I will give the general trend of the anthropometric sex differences. It will be noted that the male groups exceed the female groups in all measurements except hip circumference. With regard to length measurements, stature shows approximately 10 cm. mean difference, whereas that in suprasternal height and symphysis height is less, viz., approximately 8 cm. and 5.5 cm. respectively. This indicates a relatively longer trunk length in the female group. Thus we find that, in central tendency, the measurements of the male groups exceed those of the female in all measures except hip circumference. In length measurements the female group has a longer trunk length relative to stature. It will be noted that there is considerable overlapping of all measurements. The reason for these differences in central tendency will be found by reference to studies on growth differentials between the sexes.

Thompson (1946), reviewing the relevant literature, states that boys exceed girls in mean weight until 11 years, and that from 11-14 girls exceed boys, and by 15-16 years superiority is regained by boys, and by 20 years the mean weight of males exceeds that of females by 20 per cent.

Girls, although smaller, tend to be more mature than boys, as indicated by earlier puberty, more rapid skeletal development and earlier pre-adolescent growth spurt. In males from puberty to maturity the growth of trunk and limbs is at first equal; then there follows a period of rapid trunk growth with circumferential growth continuing longer than growth in length.

In females, from puberty to maturity, the trunk elongates in the lumbar region and the pelvis enlarges, while the lower extremities cease to grow in proportion to the trunk.

These sex differentials in physical growth will give rise to differences in central tendency of anthropometric measurements in adults, and would explain differences noted between our male and female groups.

These findings suggest that it would be inappropriate to apply body build indices derived from studies of male subjects to women, and strongly indicates that a special analysis of female body build must be made in order to derive appropriate body-build indices for women.

TABLE I.

	200 auxiliaries.		100 normal soldiers.		200 neurotic soldiers.	
	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.
Age	25.01	5.53	29.27	6.06	28.85	0.589
Stature	161.29	6.262	171.01	5.326	170.91	6.77
Suprasternal height	131.17	5.476	139.47	4.678	139.39	5.78
Symphysis height	80.95	4.641	86.39	4.55	86.51	4.81
Breadth of skull	13.34	0.568	15.27	0.52	14.92	0.58
Length of skull	17.31	0.844	19.59	0.658	19.21	0.66
Biacromial diameter	33.53	1.997	39.61	2.109	38.8	1.68
Transverse chest diameter	23.52	1.556	28.77	2.12	27.95	1.85
Sagittal chest diameter	17.24	1.206	20.6	1.633	20.39	1.58
Bicristal diameter	24.13	1.654	29.08	1.59	28.76	1.61
Length of sternum	16.30	1.118	21.89	2.23	21.2	1.78
Chest circumference	89.16	6.190	95.79	4.87	92.2	3.57
(at inspiration)						
Chest circumference	82.86	6.533	87.96	5.30	86.5	4.5
(at expiration)						
Hip circumference	82.86	6.533	79.93	6.64	80.2	5.27
Weight	55.74	7.710	65.0	6.887	64.6	7.22

FACTORIAL ANALYSIS RESULTS.

The matrix of intercorrelations of the fifteen variables on a group of 200 women service patients suffering from neurosis successively admitted to Mill Hill Emergency Hospital is shown in Table II.

It will be seen at once that all the measurements are positively correlated, indicating the presence of a general factor. The saturation of each measurement with the first factor, calculated by Burt's summation method, is shown in Table III. When the effect of the first factor is removed from the correlations we are left with the first factor residual correlations. These residuals varied from -.33 to +.50. The correlations were statistically significant, and

TABLE II.

	Stature.	Suprasternal height.	Symphysis height.	Breadth of skull.	Length of skull.	Biacromial diameter.	Transverse chest diameter.	Sagittal chest diameter.	Bicristal diameter.	Length of sternum.	Length of arm.	Chest circumference (inspiration).	Chest circumference (expiration).	Hip circumference.	Weight.
Stature	—	.9521	.8957	.1098	.2860	.4529	.2668	.3335	.2668	.5480	.7174	.1987	.3146	.3429	.4969
Suprasternal height	.9521	—	.8300	.0200	.3241	.4794	.2377	.3616	.3241	.5227	.7833	.3429	.4259	.1987	.6518
Symphysis height	.8957	.8360	—	.1889	.4168	.3616	.1494	.2764	.1889	.3616	.8249	.1790	.0998	.1889	.3429
Breadth of skull	.1098	.0200	.1889	—	.0500	.2764	.2280	0	.1889	.1593	.0300	.2280	.1889	.2860	.1593
Length of skull	.2860	.3241	.4168	.0500	—	.4529	.1593	.3051	.2860	.1692	.1987	.1494	.1692	.0200	.3051
Biacromial diameter	.4529	.4794	.3616	.2764	.4259	—	.4881	.3523	.2085	.3335	.4618	.4259	.5480	.3523	.3595
Transverse chest diameter	.2668	.2377	.1494	.2280	.1593	.4881	—	.2764	.2571	.1296	.2474	.5891	.5563	.4529	.6594
Sagittal chest diameter	.3335	.3616	.2764	0	.3051	.3523	.2764	—	.3802	.4969	.4259	.6816	.6131	.6594	.6518
Bicristal diameter	.2668	.3241	.1889	.1889	.2860	.2085	.2571	.3802	—	.3894	.4618	.3146	.4706	.6816	.4349
Length of sternum	.5480	.5227	.3616	.1593	.1692	.3335	.1296	.4969	.3894	—	.3894	.3146	.2860	.3802	.3802
Length of arm	.7174	.7833	.8249	.0300	.1987	.4618	.2474	.4259	.4618	.3894	—	.3241	.2474	.3241	.3709
Chest circumference (at inspiration)	.1987	.3429	.1790	.2280	.1494	.4259	.5891	.6816	.3146	.3146	.3241	—	.8912	.6961	.8076
Chest circumference (at expiration)	.3146	.4259	.0998	.1889	.1692	.5480	.5563	.6131	.4706	.2860	.2474	.8912	—	.7103	.7446
Hip circumference	.3429	.1987	.1889	.2860	.0200	.3523	.4529	.6594	.8616	.3802	.3241	.6661	.7103	—	.7103
Weight	.4969	.6518	.3249	.1593	.3051	.5395	.6594	.6518	.4349	.3802	.3709	.8076	.7466	.7103	—

TABLE III.

	First factor saturation.	Second factor saturation.
1. Stature	0.71	0.64
2. Suprasternal height	0.76	0.52
3. Symphysis height	0.56	0.74
4. Breadth of skull	0.11	-0.2
5. Length of skull	0.36	0.14
6. Biacromial diameter	0.67	0.04
7. Transverse chest diameter	0.54	-0.26
8. Sagittal chest diameter	0.68	-0.14
9. Bicristal diameter	0.56	-0.11
10. Length of sternum	0.56	0.10
11. Length of arm	0.68	0.42
12. Chest circumference (at inspiration)	0.72	-0.52
13. Chest circumference (at expiration)	0.74	-0.48
14. Hip circumference	0.70	-0.56
15. Weight	0.86	-0.26

it is clear that there remains something in common between traits after removal of the effect of the first factor.

The saturation of each measurement with the second factor was calculated by a similar process and is shown in Table III.

The second factor residuals were too small to make further analysis profitable. We find, therefore, that two factors are mainly responsible for the variations in female body build. The first factor accounts for 41 per cent. of the variance and the second factor 16 per cent.

DESCRIPTION OF THE FACTORS.

The first factor has positive correlations with all traits and is clearly a general factor determining body size. This factor accounts for the variation in size as opposed to physical proportions. So far we can only classify the group according to bodily size. If we take single measurements to discriminate individuals in respect to general bulk or size, weight, suprasternal height, stature, chest and hip circumference will be the most informative. Such measurements as bicristal diameter and length of sternum and skull measurements will be of little use for this purpose because of their comparatively low saturation with the first factor.

The removal of the contribution of the first factor, in effect, reduces the members of the group to the same general scale of size and enables the effect of the second factor to be ascertained.

Second factor.—From Fig. 1 and Table III it will be seen that some measurements have positive saturations and others negative saturations with this factor. The second factor is bipolar, having positive saturations for length measurements and negative saturations for breadth, width and circumferential measurements. The effect of this factor is that when length measurements are relatively large there will be relative deficiency in size of breadth and circumferential

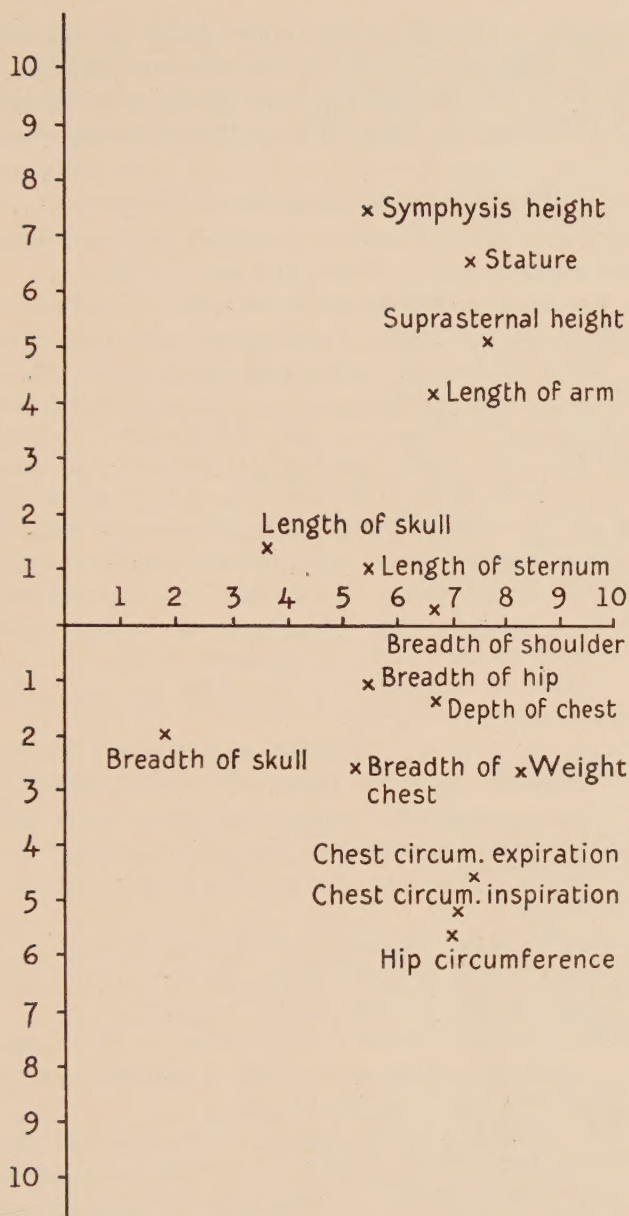


FIG. 1.—Saturation of anthropometric measurements with general and type factors.

measurements. Similarly, when breadth measurements are great, length measurements will tend to be relatively shorter. Some individuals will therefore be characterized by being broad relative to length and others slender relative to length.

This factor would therefore tend to create two antithetical types of bodily architecture, viz., a narrow, linear or leptomorph type and a broad, lateral or euryomorph type.

It is interesting to note that many authors during the past century have, unknown to each other, described more or less corresponding types of physique, although differing in nomenclature and basic criteria, with a general tendency to describe a dichotomy, as above, with intermediate types in some classifications.

RELATIONSHIP OF FACTORS TO GROWTH.

Factors elicited by factorial analysis are mathematical expressions of underlying processes which determine (a) body size and (b) body type.

Factorial analysis alone will not tell us whether the processes mathematically expressed by the factors are of genotypical rather than of phenotypical significance. There is, however, considerable evidence that the two factors revealed by factorial analysis correspond to well-defined growth processes.

Carter and Krause (1936) analysing data of Bakwen and Bakwen (1934) on neonates found that all physical measurements correlated positively, indicating the presence of a general factor at the beginning of extra-uterine life. Bayley and Davies (1935) in a study of growth during the first three years of life found evidence of a general growth factor which retarded rapidly at first, then more slowly throughout the 36 months. They found that disproportionate growth occurred at certain periods corresponding to changes in body build. Lateral growth giving rise to chubbiness rapidly increased during the first 11 months, with gradual increase of longitudinal growth after this age. These findings correspond closely to our two factors.

Mullen (1940), in a factorial study of anthropometric measurements of groups of girls of various age groups from 7-17, found in all groups a general factor and two group factors, the latter corresponding to our bipolar factor.

McCloy (1940) analysed physical measurements in groups of boys and girls at various ages from birth to puberty, and also found evidence of a general factor as well as type factors.

Thus our discovery of two main factors underlying the variations of physique in our group of adult women is confirmed by the elicitation of similar factors in groups of children of each sex from birth to maturity.

Similar factors have been found in adult groups in British soldiers (Rees and Eysenck, 1945) and in other adult groups of various racial compositions (Cohen, 1938, 1940 and 1941; Hammond, 1942).

The striking consistency of the findings of factorial analysis in widely differing groups suggests that the factors are of fundamental significance.

General observations on growth in children also lend support to the presence of type factors as well as general factors of growth. Harris (1948) describes growth in childhood as a succession of "springing up" periods alternating with "filling out" periods, which is, indeed, a graphic description of the operation of the type factor. Even in the animal kingdom, growth, according to Huxley (1932), is of two main kinds:

- (a) Isogonic—general growth,
- (b) Heterogonic—differential growth,

which appear to correspond respectively to the operation of our first factor governing general growth and to our type factor governing disproportionate

growth. These findings suggest the universality of two fundamental growth processes corresponding to our mathematical factors. Presumably such growth processes would be mainly genetically determined, and in this connection it is interesting to note that Krogman (1940) expresses the view that bodily growth is controlled by at least two sets of genetic factors, the first governing general dimensional growth, and the second purely linear or purely circumferential dimensions.

CONSTRUCTION OF AN INDEX OF BODY BUILD.

The results of factorial analysis provide us with the relevant information for the construction of indices of body build. In the past many body-build indices have been constructed empirically and a number lack any scientific basis.

The measurements that are likely to be useful in discriminating physical types will be those with high saturations with the type factor and, conversely, those with low saturations will be valueless for use in body-build indices.

An index of body build to be useful in clinical practice and research should have the following attributes: (1) Validity; (2) reliability; (3) objectivity; (4) practicability.

VALIDITY.

The validity of an index can be assessed by—

- (a) Its correlation with other indices.
- (b) Criteria derived from the results of factorial analysis.

Theoretically it would be possible to determine the validity of various body-build indices by intercorrelating each index with the other and determining the saturation of each index with the first common factor, which in this case would presumably be what each index purports to have in common, viz., the measurement of body build. This method was carried out in male groups (Rees, 1949) and was found to be unsuitable because of the spuriously high correlations produced by the inclusion of the same measurement in many of the well-known indices.

A more satisfactory method of validation is afforded by the results of factor analysis because the degree of saturation with the type factor will indicate the discriminating value of various measures in detecting body types. Thus the validity of an index may be judged by the degree to which the component variables are saturated with the type factor and the manner in which they are combined.

RELIABILITY AND OBJECTIVITY.

By the reliability of a body-build index we mean the degree of consistency obtained by repetition within a comparatively short period of time. The retest reliability of body build indices is high because the reliability of the majority of anthropometric measurements is high. Objectivity is readily achieved when measurements are taken according to strictly standardized procedures.

PRACTICABILITY.

For practical purposes the simpler the index the better, providing that efficiency is not thereby sacrificed. In the case of males simplicity was readily achieved, because two measures only were outstanding in their saturation with the type factor (Rees and Eysenck, 1945), and it was possible to use a simple ratio of the two measurements. Even computation in standard measure could be dispensed with as the correlation of the index calculated in absolute measure with its calculation in standard measure was $+ \cdot 94$ (Rees, 1949).

A NEW INDEX OF FEMALE BODY BUILD.

Inspection of Fig. 1 and Table III will reveal that in our female group there are four measurements with relatively high saturation with the type factor, viz.,

Stature	$+ \cdot 64$
Symphysis height	$+ \cdot 74$
Hip circumference	$- \cdot 56$
Chest circumference	$- \cdot 52$

The fact that there are four measurements with relatively high saturation with the type factor, and therefore the ones most useful for inclusion in a body-build index, precludes the computation of a simple ratio as an index of female body build.

From a statistical point of view the ideal index of body build would be a regression equation containing all the anthropometric measurements weighted according to the type factor. Such an index, however, would be very cumbersome and would involve tedious calculation.

It was therefore decided to limit the regression equation to the above four measurements having the highest saturation with the type factor. By means of Aiken's method of pivotal condensation (Thompson, 1939), a regression equation of the four measurements weighted according to saturation with the type factor was calculated. The resulting equation for female body build was as follows :

$$\text{Index of female body build} = + \cdot 59 \text{ stature} + \cdot 47 \text{ symphysis height} - \cdot 31 \text{ chest circumference} - \cdot 64 \text{ hip circumference.}$$

The measurements in the regression equation are expressed in standard measure.

The index should now be considered with regard to the above-mentioned prerequisites of an index of body build.

The validity of the index should be high, because the selection of measurements and the manner of combination and weighting into a regression equation was governed by the results of the inductive method of factor analysis, which appears to be our best method of validation.

Reliability and objectivity are achieved because the anthropometric measurements used have a high retest reliability and are taken according to standardized methods.

While simplicity has practical advantages, it must not be derived at the expense of validity and efficiency. In the female group under consideration it was not feasible to devise a simple ratio as body-build index as in the male group (Rees and Eysenck, 1945). Whilst ideally a regression equation should contain all the measurements duly weighted according to correlation with the type factor, this would make the index very complicated and difficult to compute. Accordingly the equation was limited to the four measurements having the highest saturation with the type factor. It was considered that further simplification could not be achieved without loss of validity and efficiency.

FREQUENCY DISTRIBUTION OF THE NEW INDEX OF FEMALE BODY BUILD.

The index was calculated for 400 female service neurosis patients successively admitted to Mill Hill Emergency Hospital. The mean was found to be $+1.385$ and standard deviation ± 3.68 . The frequency distribution curve of the index in the group is shown in Fig. 2. It will be seen that the distribution of the index of female body build is along a normal frequency curve with some tendency to positive skewness. We find a continuous variation in physique, from a broad (eurymorphic) type with high index values at one extreme to the other extreme with a narrow (leptomorph) type with low index values.

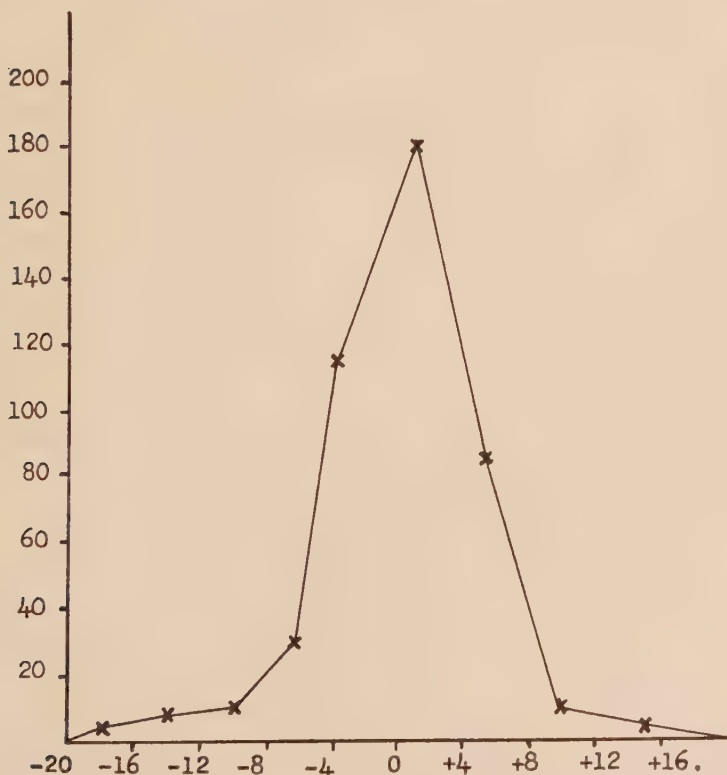


FIG. 2.—Frequency distribution curve of a new index of body build in a group of 400 women.

We find, as in the male group, a leptomorphic-eurymorphic continuum in a unimodal curve. There is no evidence of any bimodality or multimodality which would be an indication of physical types in the sense of discrete and mutually exclusive categories. The index, therefore, measures the position of the individual in the normal distribution curve of body build. The extremes of the curve only, impress us as well marked and antithetical types. There are no natural dividing points, and any division of the curve into physical types, although convenient and at times necessary for purposes of research, will be arbitrary. A statistically acceptable arbitrary demarcation point would be one standard deviation above and below the mean dividing the curve into three classes.

The three classes are demarcated as follows :

1. *Leptomorphs* with small breadth, width and circumferential measurements relative to length. Index values $+ \cdot 5\cdot 0$ and higher.
2. *Eurymorphs* with high circumferential measurements relative to length. Index values $- 2\cdot 59$ and less.
3. *Mesomorphs* with an intermediate relationship between lateral and linear measurements. Index values between $- 2\cdot 59$ and $+ \cdot 5\cdot 0$.

This division of the normal frequency distribution of body build is not in any way intended to convey the impression that these classes are disparate types. These categories of physique are ranges of body build objectively measured by a new index of female body build, and demarcated by a statistical criterion for purposes of description and research.

SUMMARY.

1. The paper describes a factorial analysis of the intercorrelations of 15 anthropometric variables in a group of 200 service women neurosis patients successively admitted to Mill Hill Emergency Hospital.
2. The criteria used in the past for classifying body build are described, and the need for an inductive approach emphasized. The difficulties encountered in classifying female body build are discussed, and anthropometric sex differences considered in the light of a comparison of male and female groups and sex growth differentials.
3. The matrix of tetrachoric correlations of the 15 anthropometric variables was analysed by Burt's summation method and two main factors were extracted:
 - (a) General factor influencing growth in all directions and accounting for 41 per cent. of the variance.
 - (b) Type factor which was bipolar, having positive saturation with length measurements and negative saturation with breadth, width and circumferential dimensions. This factor accounted for 16 per cent. of the variance, and is the factor responsible for the existence of two antithetical types of body build, the narrow or leptomorph and the broad or eurymorph type.
4. The relationship of the factors to growth processes is considered in relationship to physical development of children at various ages, types of growth in animal kingdom and genetic aspects.

5. The prerequisites of a body-build index are described. Utilizing the results of factor analysis, the following measurements were selected for inclusion in a body build index because of their high saturation with the type factor: Stature, symphysis height, chest and hip circumference.

A regression equation containing the four measurements duly weighted according to saturation with the type factor was calculated as follows: Index of female body build = $+ .59$ stature $+ .47$ symphysis height $-.31$ chest circumference $-.64$ hip circumference.

6. The new index of female body build was calculated in a group of 400 women service neurosis patients. The frequency distribution curve of the index was normal and unimodal, indicating a continuous variation in physique, therefore lending no support to the theory of the existence of discrete physical types.

7. Using demarcation points at one standard deviation below the mean the frequency distribution curve was divided into—

- (1) Leptomorphs with index value $+ 5.0$ and higher.
- (2) Mesomorphs -2.59 to $+ 5.0$.
- (3) Eurymorphs -2.59 and less.

These ranges of physique, being capable of objective delineation by the new index of body build, afford convenient body-type classes for clinical practice and research.

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A FOLLOW-UP INVESTIGATION OF 330 CASES TREATED BY PREFRONTAL LEUCOTOMY.*

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BETWEEN 11 October, 1942 and 31 December, 1947, the operation of pre-frontal leucotomy was carried out on 345 patients at the Graylingwell Hospital, Chichester. The technique was similar to that of the standard method of Freeman and Watts: in each case the operation was performed by Mr. A. G. Ross. The paper reports the results of a clinical follow-up investigation in 330 of the cases; the remaining 15 could not be traced.

Method of follow-up investigation.—The aim was to establish the mental condition of the patients operated on during the above period. The examination consisted of one or two psychiatric interviews, which were as comprehensive as possible. All interviews were conducted by the author. No psychological tests were carried out. In each case at least a year had elapsed between the operation and the follow-up examination. Miss Nancy G. Cook, the Psychiatric Social Worker attached to the Department of Clinical Research, interviewed the patients' relatives, and sometimes their employers, prior to the psychiatric examination. The discharged patients were visited at their own homes. As a rule only one visit was made by the psychiatrist, who, in most cases, also saw the relatives, while it was often necessary for the social worker to make several visits to collect all the information available. The investigators met with most gratifying co-operation from the discharged patients and their relatives. Only in 4 cases was information withheld; in some instances over-solicitous relatives, while anxious to report on the patient's condition, requested the psychiatrist not to see the patient out of fear that his visit might have an untoward effect. The patients who had remained in hospital were re-examined, and, where possible, visiting relatives were interviewed for the purpose of obtaining their impressions on the change that the patients had undergone since the operation.

Only a small number of cases, i.e. those operated on during the last 5 months of 1947, had been known to the author before the operation, but the case notes and the information obtained from his colleagues and the patients' relatives enabled him to form an impression of the pre-operative condition of the rest of the cases. The author was not concerned with the selection of the cases

* A preliminary report of the results of this investigation was given at the International Conference for Psychosurgery at Lisbon in July, 1948. Stengel, E., and Carse, J. (1948), *Act. Luso-Espan. Neur. Psiquiat.*, **7**, 312.

for operation. The provisional results of the operation in the first 200 cases were reviewed by J. Frank (1946). The investigations underlying the present report have been carried out independently of Frank's work. The indications for the operation at the Graylingwell Hospital were, as Frank stated, on the whole identical with those laid down by Freeman and Watts.

An investigation such as this, although it has fewer fallacies than follow-ups based on questionnaires, correspondence and social workers' visits alone, is still far from satisfactory. In some discharged cases, repeated interviews spread out over a certain period might have established a more complete picture of the patient's condition than it was possible to obtain by one or two visits. Another fallacy springs from the grouping together of cases operated on 1 to 5 years prior to the re-examination. An attempt has been made, where possible, to assess separately the cases operated on in various periods.

In the course of the present examination it became clear that information obtained from the relatives alone, as well as impressions gained from the interview with the patient only, however thorough, may be very misleading. In most cases the patient's post-operative condition could be assessed only when information from both sources was available. The information obtainable has not, of course, been equally comprehensive in all cases.

Cases where information of progress could be obtained by correspondence only will be grouped separately. The post-operative condition of patients who died from intercurrent illnesses prior to this follow-up, has not been assessed clinically for the purpose of this report. The information concerning their progress after operation was not comparable with that available in the rest of the cases.

Table I gives the numbers of patients discharged, still in hospital, dead and untraced.

TABLE I.—345 Cases Operated on by Leucotomy.

	Schiz. and par.	Affect.	Others.	Totals.
Discharged, followed up by interview .	65	69	13	147
Discharged, followed up by correspon- dence	9	5	1	15
In hospital at the time of investigation	115	8	11	134
Dead	20	13	1	34
Not traced	—	—	—	15
Totals	209	95	26	345

Grouping of material.—The cases have been grouped according to current diagnostic classification. However, as the various clinical reaction-types embrace cases of very different severity and prognosis, an endeavour has been made to subject every case to a structural analysis with a view to establishing which features of the personality or the syndrome present before the operation could be related to changes following the operation. It was also the purpose of this analysis to find out whether or not individual patients had shown

certain peculiarities in their psychotic reactions or personalities, which were in the nature of assets or liabilities as far as short-term prognosis was concerned. It also aimed at establishing the presence of mixed syndromes, such as schizophrenic reactions with depressive features or vice versa. In this way the well-known fallacies of psychiatric classification can be reduced. It is generally accepted that, from the point of view of short-term prognosis, it is not decisive whether a case is diagnosed as a depression with schizophrenic features, as a schizophrenic reaction with depressive features or as a schizo-affective state. A list of about 75 items was drawn up, and the relevant data filled in as fully as possible in every case. The information on many of the items was incomplete and therefore insufficient to be taken into account, e.g. data concerning heredity were too scanty and unreliable to be of value. This report is concerned only with the change in the clinical condition of the patients which had taken place by the time of the re-examination and reference will only be made here to some of the items which could be established in the majority of the cases with a certain degree of reliability. The material will be subjected elsewhere to an analysis from other angles.

In classifying the clinical condition on re-examination the following categories have been distinguished :

Full Remission, i.e. disappearance of symptoms and return to the same or almost the same state of mental health and efficiency as before the onset of symptoms.

Much Improved, i.e. some slight residual symptoms only are present, without interfering seriously with the patient's conduct, which is similar, or almost similar, to that before the illness.

Improved, i.e. symptoms still present, but definitely less severe.

Unchanged, Conduct Improved.

Unchanged.

Unchanged, Conduct Worse.

Dead, i.e. (a) died within 2 months after the operation ;

(b) died later than 2 months after the operation.

The term " Full Remission " is preferable to that of " Recovery " or " Cured," especially in a survey which covers a comparatively short period following treatment ; it does not have the ring of finality of the latter terms ; it refers to the symptoms of the illness only, and makes some allowance for certain defects which careful examination rarely fails to reveal in schizophrenics who have made a full recovery with or without treatment. The term " Social Recovery " has been avoided, as it is liable to be applied too widely.

A classification of the results of leucotomy which takes into account the change of symptoms only would not be entirely satisfactory. The total result should, if possible, be judged by the effect of the operation, not only on the symptoms, but also on the personality. The distinction between effects on the mental condition and on the personality is, of course, an artificial one, because it is in all likelihood the same physiological change which affects the mental symptoms and the personality, and also because, clinically, such a distinction is difficult to make, especially in schizophrenics with only partial improvement. The distinction, however, is possible, up to a point, in cases which have made

a full remission. The changes in the symptoms and in the personality make up the total result, i.e. the patient's total adjustment to reality. This will be assessed here for the highest degree of improvement (full remission) in schizophrenics only.

In assessing results it is necessary to be clear whether one is setting out to judge the changes following the operation against mental health ("absolute" result), or against what could be expected in an individual case (relative result). The result of an operation which has turned a destructive chronic catatonic into a useful or more tolerable member of the chronic hospital population, although he may still be hallucinated and deluded, can be regarded as relatively very satisfactory. Judged against mental health it is, however, poor. The general application of the first standard (absolute result), therefore, does not do justice to the effects of the operation on chronic cases. In those cases the relative results are sufficiently reflected in the change of symptoms. The result will be classified as "very good" in those patients who underwent a full remission, showed only a slight personality change or none at all, fully regained or improved their social status and had no epileptic fits. The result will be classified as "good" where a full remission was associated with a definite loss of social status attributable to the personality change, or with the occurrence of late epileptic manifestations; as "fair" where the patient was unable to make an adjustment notwithstanding the disappearance of psychotic symptoms. No assessment of absolute results has been carried out in the affective psychoses, as in the majority of cases of that group there is a marked tendency to recurrence, and the time which has elapsed since the operation is too short for the results to be assessed in this way.

An assessment of "absolute" results, similar to that proposed here, has been carried out by Garmany (1948).

200 CASES OF SCHIZOPHRENIC REACTION TYPES AND PARANOID STATES.

Two-hundred-and-nine of the 330 cases which could be reviewed were patients in whom the diagnosis of one of the above-named reaction types was made. In 200 of these it was possible to obtain fairly full and uniform information. Nine cases could be followed up by correspondence only, and will be dealt with separately. All the patients had, prior to the operation, failed to respond to insulin or electro-convulsant therapy.

Table II shows the proportions of those discharged, still in hospital, and dead by December, 1947, excluding those followed-up by correspondence only.

TABLE II.—200 *Schizophrenics and Paranoid States*.

				M, male; F, female; T, total.											
Discharged.				In hospital.				Dead.				Totals.			
M.	F.	T.		M.	F.	T.		M.	F.	T.		M.	F.	T.	
30	35	65	.	54	61	115	.	9	11	20	.	93	107	200	

Table III shows the number of patients operated on during each year covered by this survey. The fall in the number of operations in 1947 was

TABLE III.—209 *Schizophrenics and Paranoid States. Number of Cases Operated on in Each Year Under Survey. First Operations.*

	M.	F.	T.
1942	5	3	8
1943	16	15	31
1944	27	23	50
1945	25	24	49
1946	17	30	47
1947	4	20	24
Totals	94	115	209

mainly due to the fact that the majority of suitable cases among the chronic schizophrenics had already been dealt with, and also to a tightening up of the indications in the light of increasing experience.

Table IV illustrates the social status of the 180 patients still living, according to the classification of Freeman and Watts.

TABLE IV.—180 *Living Patients with Schizophrenic and Paranoid States Followed up by Interview. Their Social Status Assessed According to the Criteria of Freeman and Watts.*

Employed.			Partly employed.			Keeping house.			At home.			In hospital.		
M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
14	8	22	4	..	4	..	19	19	12	8	20	54	61	115
(12.2%)			(2.2%)			(10.6%)			(11.1%)			(63.9%)		

Table V shows the distribution of the various reaction types and the mental state of the patients at the time of their re-examination. The term "paraphrenia" has, according to current usage, been applied to designate paranoid states with delusions and hallucinations, but without thought disorder and signs of personality disintegration. The percentage of male patients classified as full remissions was higher than that of the females.

In Table VI the patients treated in each of the 6 years under review have been grouped separately. It shows that none of the cases operated on in 1947 had undergone a full remission. This appears, at first sight, to be due to the fact that the time which had elapsed since the operation had not been sufficient for the effect to mature. However, the analysis of the individual cases operated on during that year makes it seem unlikely that there will be a material change in the figures for the highest grades of improvement. Of the 20 patients operated on in 1947 who were interviewed, only one had been ill for less than 2 years, and only 3 for less than 4 years before the operation. None of them showed any marked improvement at the time of re-examination. As Table VIII indicates, the great majority of cases classified as "Full Remission" and "Much Improved" come from those with an onset of under 4 years before the operation. Considering also that signs of a favourable outcome are usually

TABLE V.—200 Schizophrenics and Paranoid States, Grouped According to Reaction Types.
Their Mental States on Re-examination.

Reaction types.	Full rem.			Much impr.			Impr.			Unchanged, conduct impr.			Unchanged.			Worse.			Dead.			Totals.		
	M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.		
	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
Catatonia . . .	5	2	7	2	1	3	3	2	5	10	6	16	3	7	10	2	2	4	2	3	5	27	23	50
Schiz. simpl.-heb.	..	..	..	1	1	2	5	1	6	11	4	15	6	4	10	..	..	..	1	3	4	24	13	37
Par. schiz. . .	6	3	9	2	5	7	6	4	10	8	7	15	7	8	15	..	5	5	3	5	8	32	37	69
Paraphrenia . .	1	5	6	1	1	2	1	8	9	1	15	16	2	4	6	..	1	1	1	..	1	7	34	41
Senile par. state .	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	2	..	2	3	..	3
Totals . . .	12	10	22	6	8	14	15	15	30	31	32	63	18	23	41	2	8	10	9	11	20	93	107	200
Percentage . .	11			7			15			31.5			20.5			5			10			100		

TABLE VI.—200 Schizophrenics and Paranoid States, Grouped According to the Year of Operation.
Their Mental States on Re-examination.

Year.	Full rem.			Much impr.			Impr.			Unchanged, conduct impr.			Unchanged.			Worse.			Dead.			Totals.			Year.
	M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.			M. F. T.			
	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	
1942	2	..	2	..	..	..	..	..	..	..	..	3	1	4	1	..	1	..	..	..	..	6	1	7	1942
1943	1	1	2	..	2	2	4	2	6	9	3	12	..	3	3	1	1	2	1	3	4	16	15	31	1943
1944	3	2	5	3	1	4	2	2	4	7	7	14	5	10	1	2	3	4	4	8	25	23	48	1944	
1945	4	3	7	2	2	4	5	4	9	8	4	12	5	11	..	..	..	1	2	3	25	21	46	1945	
1946	2	4	6	1	2	3	3	4	7	7	9	16	3	6	9	..	2	2	1	1	2	17	28	45	1946
1947	..	..	..	..	1	1	1	3	4	..	9	9	1	3	4	..	2	2	2	1	3	4	19	23	1947
Total.	12	10	22	6	8	14	15	15	30	31	32	63	17	24	41	3	7	10	9	11	20	93	107	200	

marked by the end of the first year after operation, it is unlikely that the number of those with the highest grades of improvement among the 1947 group will increase in the course of time. The one patient assessed as "Much Improved" was a case of paranoid schizophrenia, with an onset 9 years before operation, who showed a number of assets usually found in those who had improved greatly after the operation (see below).

The following tables refer to the 65 discharged patients only. Table VII groups these patients according to reaction types.

TABLE VII.—65 Discharged Schizophrenics and Paranoid States.

Catatonia.			Schiz. simplex—hebephhr.			Par. schiz.			Paraphr.			Totals.		
M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
10	4	14	4	2	6	14	9	23	2	20	22	30	35	65

Table VIII analyses the discharged cases according to the duration of the last attack prior to the operation and demonstrates the degrees of improvement. As the onset of symptoms is often difficult to establish retrospectively, the figures relating to onset have to be treated with reserve.

The average age of the discharged cases was 36 for the males and 44 for the females. This may partly account for the higher proportion of full remissions among the males. This suggestion is supported by the fact that the average age of the male patients with the best outcome was 36, and that of the females 40. If the discharged patients are subdivided into paranoid states and other reaction types, their average age is, for the paranoid states, males 41, females 43; for the other reaction types, males 32, females 39, respectively.

Full remission.—Twenty-two cases (12 male, 10 female), as shown in Table V, were assessed as full remission. Among these patients there was no case of the schizophrenia simplex—hebephrenia type. Seven belonged to the catatonic type and the rest to the paranoid group. Of the latter reaction types 9 were paranoid schizophrenics, 5 paraphrenics, and 1 (Case Br., male) was probably a case of long-standing paranoia. In the latter case the information available from the relatives was incomplete. Eighteen cases showed manic-depressive features. In 7 cases the attack which had led to their admission, prior to leucotomy, was the first one; the remainder had had previous attacks from which they had recovered prior to the attack during which they had been operated on.

In none of these cases had the previous attacks followed a regular periodicity. There were 4 cases which had, by the time of their re-examination, remained free from relapse longer than before their last attack. Table IX shows the number of previous attacks in these 4 cases, the length of the intervals between each attack and the period of freedom from symptoms since the operation. In the remainder of the recurrent cases the time that had elapsed since the operation had by then not exceeded the intervals between previous attacks.

All cases classified as full remissions showed certain features which, from the point of view of short-term prognosis, are generally regarded as assets, such as well-preserved personality, intelligence not below average, manic-

TABLE VIII.—65 Discharged Schizophrenics and Paranoid States Grouped According to Duration of Last Attack Before Operation.
Their Mental States on Re-examination.

Duration of last attack before operation.	Number of patients.			Full rem.			Much impr.			Impr.			Unchanged, conduct impr.			Unchanged.		
	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
Under 2 years	12	16	28	11	7	18	1	4	5	..	4	4	..	..	..	..	..	..
2 to 4 years	9	8	17	..	3	3	5	2	7	3	1	4	1	1	2	..	1	1
5 to 9 "	4	6	10	..	..	..	..	2	2	1	2	3	3	3	6	..	..	..
10 to 19 "	4	4	8	1	..	1	..	..	..	2	2	4	1	1	2	..	..	..
20 years and over	1	1	2	..	..	..	..	..	..	..	..	..	1	1	2	..	1	1
Totals	30	35	65	12	10	22	6	8	14	6	9	15	6	6	12	..	2	2

TABLE IX.—4 Cases (Full Remissions) who had, following Leucotomy, been Free from Attacks longer than before the Last Attack.

Case.	Year of operation	Number of previous attacks.	Previous intervals (in years).	Number of years free from attack since operation.
Bu— .	1942	2	9 ; 1	6
Ri— .	1943	1	2	5
Ch— .	1944	3	12 ; 2	4
Hu— .	1944	1	3	4

depressive features, tendency to remission in the past, good work record prior to the last attack. In 81.8 per cent. of the cases who made a full remission the duration of the last attack had been less than 2 years, and in 13.7 per cent. between 2 and 4 years. In this respect these cases differ significantly from those who were still in hospital. Of the 115 still in hospital the duration of the last attack, prior to the operation, could be approximately assessed in 110 cases: in only 10 per cent. had it been less than 2 years, and in about 21 per cent. 2 to 4 years.

Of the total results in the cases which underwent a full remission, 8 (6 female, 2 male) were assessed as very good, 3 as fair, and the rest as good. Of the 12 male patients assessed as full remissions, 5 were working at the same professional level as before their last attacks, 4 at a lower level, 3 were doing no work, one of them having reached retiring age. Of the 5 who had maintained their professional standard, 2 were clerks, one a compositor, one a salesman and one a butcher. Of the 4 working at a lower level, 2 had been small business people who were now working as unskilled workers, one was a language teacher who could now work only half-time, and one who had been a skilled worker before was now working in an unskilled capacity. Of the 3 who were doing no work, one had owned a butcher's shop, one had been a radio operator, and the third, who was 67 at the time of the re-examination, had previously been an unskilled worker. Among the 10 female patients assessed as full remissions, there was a district nurse who had resumed her work and was doing it well. The others were employed in domestic duties, working in their own or their parents' households, and the quality of their work had not suffered noticeably. Two of the cases with full remission, both male, have had epileptic attacks, the first occurring in one case 7 months, in the other 5 years after leucotomy.

The age of the patients classified as full remission ranged from 21 to 63 at the time of operation. The average age of the male patients was 36, of the females 40.

Among the 6 male patients classified as "much improved," one was a retired officer who was doing no work, 3 who had been unskilled labourers before their last attack were working and earning minimum wages, one who had been doing clerical work before, was doing nothing, and one who was deaf and dumb and had previously been a student in an art school, was still at home without work $4\frac{1}{2}$ years after the operation. Of the 12 "much improved" female patients, 10 were doing housework more or less satisfactorily, one earned her keep by dressmaking, which she had done before her illness, and one, the

daughter of a wealthy stockbroker, was working as a kitchen hand away from home, earning minimum wages but supported by her parents.

Personality changes.—In 3 of the 22 cases classified as full remissions, no personality changes could be established from the information available. The relatives and the patients themselves had in each case been interviewed, but not the employers and workmates. One of the cases was the nurse mentioned above. In 4 cases no marked personality changes were elicited, but there were indications that such changes were present to a slight degree. In the remaining 15 the well-known features of the frontal lobe syndrome were quite obvious. Apathy and increased irritability were the most constant. In all the other discharged patients personality changes were present, and they could also be established in most of the patients who had remained in hospital. It is not intended to enter into a description of the various features of those well-known changes which, in the majority of cases, contributed to the improvement in conduct. The composite picture of the personality of the improved patient was identical with that drawn by Frankl and Mayer-Gross (1947). While, in this material, apathy of various degrees was one of the most common features of the personality change following leucotomy, there was a group of patients, comprising 18 in all, who showed marked restlessness and inability to relax. In one of the discharged schizophrenic patients this symptom led to the urge to make unnecessary journeys almost daily. This peculiarity could not be correlated to any other feature of either the psychosis or the pre-psychotic personality. It was also observed in 4 cases belonging to the affective reaction types (see below).

Discharge.—All patients had, following the operation, been subjected to a routine of rehabilitation, which varied according to their individual needs and the degree of improvement. They received intensive occupational therapy and took part in planned social activities. Supportive psychotherapy was also given wherever possible. Some patients who had shown marked improvement, and whose home environment promised to contribute to their rehabilitation more than hospital treatment, were allowed home on trial as early as two months after the operation, provided the relatives could be relied on to follow the hospital's instructions. This applied particularly to patients who worked on the land.

Two of the male patients assessed here as full remissions had had short relapses necessitating their readmission before they were finally discharged. One was a male paranoid schizophrenic who was readmitted 5 months after his first discharge, having left hospital on trial 10 weeks after operation. He was finally discharged a month later. The second, who had left hospital on trial 6 weeks after the operation, was readmitted 6 weeks later and discharged again after 2 weeks. None of the female cases of this grade of improvement was readmitted.

Other readmissions.—Of the 54 male patients in hospital at the time of the re-examination, 11 had been at home for a period following the operation. Seven of them were readmitted after having been at home 3 to 11 months, 3 had been at home for 2 years and 3 months, 2 years and 9 months and 5 years respectively. One patient, a case of paranoid schizophrenia who was discharged

much improved, was readmitted with a complete relapse after 2 years. The others were on their discharge either improved or unchanged with conduct improved.

Of the 61 female patients in hospital, 9 had been readmitted after varying periods at home, 5 having been at home for less than a year, and the rest for 13 months, 14 months, 20 months, and 3 years respectively. In no case had the operation been followed by more than a slight degree of improvement.

Patients classified as "worse."—These were the cases whose psychotic condition had not changed following the operation, but whose conduct had deteriorated. They were either more aggressive or more apathetic, or their habits were worse than before. Two of them had had a short period of slight improvement following the operation. All were deteriorated schizophrenics with a poor prognosis. No definite statement can be made as to the difference between these cases and other deteriorated cases who remained unchanged or even showed an improvement in conduct after the operation.

Hallucinations and delusions.—Of the 180 cases interviewed, 154 had suffered from hallucinations and 160 from delusions prior to the operation. Table X shows the number of patients in whom these symptoms had disappeared or had been reduced following leucotomy.

TABLE X.—180 Cases of Schizophrenic and Paranoid States.

Number of cases with halluc.		Halluc. reduced.		Gone.		Unchanged.
154	.	8	.	29	.	117
Number of cases with delusions.		Delusions reduced.		Gone.		Unchanged.
160	.	22	.	22	.	116

Nine cases followed up by correspondence only.—In the majority of these cases the written information received was incomplete and the assessment of their condition is based on scanty information only. All but one of the patients were female. Of the 9 cases 2 were catatonics and 7 paranoid psychotics. The information received suggested that 5 might have undergone a full remission, 3 might be much improved and one improved. For reasons mentioned above, these cases have been kept separate from those which it was possible to investigate more closely.

Deaths.—Twenty patients in this group had died, 6 of them within 2 months of the operation. In only 3 of these 6 cases was death directly due to the operation, the cause being cerebral haemorrhage; in the other 3 cases the causes of death were bronchopneumonia, uraemia (the patient had had one kidney removed because of tuberculosis), and polycystic disease of the lungs.

Thirteen patients died from intercurrent conditions. Three of these died in the course of coma treatment which they received some time after the operation—one under electronarcosis 2 years after the operation, one as the result of irreversible coma during insulin treatment 2½ years following leucotomy, and one in a status epilepticus, also during insulin therapy, a year and 3 months

after the operation. Three patients died of cancer of the pancreas, the oesophagus and the lungs respectively. Four patients, all female, died of tuberculosis of the lungs, respectively 7 months, 19 months, 22 months and 3 years after the operation. One patient died of septicaemia and nephritis 13 months after operation, one of heart failure 16 months after operation, and one of pneumonia 3 years after operation.

In one case, where death occurred 2 years following leucotomy, no information was available regarding the cause.

In none of the patients who died from intercurrent conditions had the psychiatric improvement been more than slight.

AFFECTIVE REACTION TYPES.

Ninety-five cases belonging to the affective reaction types were followed up, 5 of them by correspondence only; the following observations refer to the remaining 90 patients.

Table XI demonstrates the numbers discharged, in hospital and dead at the time of the re-examination.

TABLE XI.—95 Cases with Affective Reaction Types.

	M.	F.	T.
Followed up by interview	32	45	77
Followed up by correspondence	..	5	5
Dead	3	10	13
Totals	35	60	95

The 77 cases re-examined clinically have been grouped according to reaction types, namely: (1) recurrent depressions; (2) recurrent mania; (3) manic-depressive illness, (a) predominantly manic, and (b) predominantly depressive; this subdivision recommended itself in the light of the observations on the effect of leucotomy; (4) involutional depression; (5) senile affective states. Table XII shows the number of cases and the average age of the patients belonging to each group. The study of the histories of these patients brought home the intrinsic difficulty of separating involutional depression from other affective reaction types, especially if one is dealing mainly with depressive states in middle age. If one restricts the term "involutional depression" to depressive states occurring for the first time in the involutional period of life, then a considerable number of cases have to be classed under some other subdivision because they have had periods of affective illness earlier in life, although in every other respect the depression which formed the indication for leucotomy was similar to that of the involutional cases in the narrow sense. But, as Table XII demonstrates, in the material under survey even the cases belonging to the other subdivisions were middle-aged at the time of operation. Practically all cases, therefore, had at the time of operation already reached or were near to the involutional period of life, apart from the few senile patients. The younger age groups were not represented among the affective reaction

TABLE XII.—77 Cases with Affective Reaction Types.

Reaction types	Rec. depressions.			Rec. mania.			Man.-depr.			Invol. depr.			Senile depr.			Totals.		
	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
Number of cases	8	8	16	1	11	12	11	13	24	10	23	33	2	1	3	32	45	77
Average age	45·2	41	..	60	..	..	54·6	45·7	..	59·2	53·7	..	71	68	..	..	..	..

TABLE XIII.—*Recurrent Depressions.*

Number of cases.	Full remission.	Mitig. chron. depr.	No change.	Level of work of disch. patients.						In hospital.	Marked undir- able personality change.
				Same.			Lower.				
M. F. T. 8 8 16	M. F. T. 6 7 13	M. F. T. 2 .. 2	M. F. T. . . I I .	M. F. T. 2 2 4	M. F. T. 4 5 9	M. F. T. 2 .. 2	M. F. T. I I .	I I .	M. F. T. 2 I 3		

types as, naturally, leucotomy was considered to be indicated only in those cases of recurrent psychosis in which the likelihood of recovery without operation was held to be very small. No attempt has been made to differentiate in this material between mainly reactive and mainly endogenous reaction-types.

Outcomes.—In attempting to judge the outcome in cases of affective psychoses, the following aspects have to be considered: (a) the effect on the condition which had been present at the time of the operation; (b) the effect on the tendency to recurrence and the periodicity, and, in case of relapse after the operation, the possible modification of the recurrent psychosis; (c) the personality change. In cases which had previously shown a tendency to remission with or without shock treatment, the value of leucotomy can be assessed only after a much longer period of time than that covered by this survey. However, it will be of importance to note whether a patient has, following the operation, so far remained free from recurrence longer than before. Cases with regular periodicity are very rare. Besides, there is reason to believe that they have become even rarer since the introduction of shock treatments which, though not preventing recurrence, often seem to change the rhythm of periodic psychoses and to break up chronic psychotic states into irregular periods of illness. Of the recurrent cases surveyed, only two had, prior to the operation, shown a regular periodicity. All the cases under review had had shock treatment at some time prior to the operation.

The following changes have been found after the operation in cases of the affective reaction types:

(1) *Full remission*, which in a considerable number of cases ensued immediately after the operation. In a proportion of the cases a period of mild elation preceded the return of full normality as far as the symptoms of the psychosis were concerned. In others the symptoms receded gradually within a few weeks or months. The clinical observations at the writer's disposal were not sufficient to allow a statement as to the proportion of cases in which remission set in gradually or suddenly.

(2) Full remission followed by *relapse* after some interval. The recurring psychosis was usually less severe than the previous attack, as far as depth of mood disorder was concerned.

(3) No remission, but *mitigation* of the existing mental condition. This was observed in depressions only. The depressive symptoms had decreased in depth. The patients would continue to express their old complaints, but the accompanying affect would be either much shallower or one of facile apathy. In a few cases the combination of mild depression with euphoria or apathy had produced a permanent condition reminiscent of a mixed affective state.

(4) *Fragmentation* of the depression. In a small number of patients the depression had subsided, but on closer inquiry they were found to be suffering from short and mitigated periods of their previous condition, lasting for a few days only.

(5) No material change.

(6) Mental condition *unchanged*, *conduct worse*. There were 3 cases with manic symptoms which, after the operation, showed even greater irresponsibility and lack of inhibition than before.

Tables XIII, XIV and XV illustrate the changes found on re-examination of the cases with recurrent depression, manic-depressive reaction types and involutional depression. The cases listed in Tables XIV and XV, under "Relapse Mitigation" and "Relapse Fragmentation," had had periods of mood disorder since the operation, but were found free from symptoms of affective disorder at the time of re-examination. They were therefore included among the fully remitted cases. On the other hand, among the cases classified as unchanged, some had had periods of remission between operation and re-examination, but these remissions had not been of longer duration than previous intervals between attacks.

Table XIII demonstrates the changes found in the patients who had been suffering from recurrent depressions, the level of work they had attained following discharge from hospital, and the emergence, in 3 cases, of marked antisocial personality features. Each of these three patients had, in the course of the depressions, shown thought contents of an aggressive nature and hostility against the environment.

In Table XIV the cases of manic-depressive reaction types are grouped according to the mood disorder which had been most marked in the course of their illness. In this group, as a whole, the number of patients who had developed marked anti-social personality features following leucotomy was comparatively higher than among the recurrent depressions. Of the 7 cases in which the operation had been carried out in a manic period, 4 were unchanged, 2 showed a full remission, and 1 was much improved with considerable mitigation of his manic symptoms. Among the group of 7 patients, therefore, who had had both manic and depressive attacks, all the cases in which the operation failed to bring about a change in the clinical condition had been operated on in a manic state.

Table XV analyses the group of involutional depressions. Three of the cases which, on re-examination, were found free from symptoms had since the operation had periods of comparatively mild depression lasting for a few months only, while one male patient had had several times a year since the operation brief periods of mild depression without known cause, lasting for about a week ("fragmentation"). The number of patients, therefore, who had kept well without relapse of any kind by the time of the re-examination was 21 (63.6 per cent.).

Among the cases operated on there was one with recurrent mania. He was 60 at the time of operation, which took place in March, 1944. He had developed marked antisocial personality changes (irresponsibility, aggressive behaviour complete lack of consideration for his relatives). Prior to the operation he had, in the intervals between his attacks, been an excellent worker, husband and father. Since leucotomy he had worked only occasionally, and had not held a job for longer than a week. His condition could be regarded as one of chronic mania with marked antisocial tendencies. Compared with his previous attacks, which had lasted not longer than 15 months, his chronic condition could be regarded as mitigated. While during each of his three previous attacks he had to be in hospital, he has so far been able to live at home since 1944, though causing almost constant irritation and annoyance to his relatives.

TABLE XIV.—*Manic-*
(A. predominantly *manic*;

Number of cases.	Full. rem.	Relapse mitigation.	Relapse fragmentation.	Mitig. chronic.	No change.
M. F. T.	M. F. T.	M. F. T.	M. F. T.	M. F. T.	M. F. T.
A.					
6 4 10 .	2 3 5 .			1 . . 1 .	3 1 4
B.					
9 5 14 .	4 9 13 .	. . 1 1 .	1 1 2 .	1 . . 1 .	

TABLE XV.—*Involu-*

Number of cases.	Full remission.	Relapse mitigation.	Relapse fragmentation.	Chronic mitigation.	No change.
M. F. T.	M. F. T.	M. F. T.	M. F. T.	M. F. T.	M. F. T.
10 23 33 .	8 17 25 .	. . 3 3 .	1 . . 1 .	2 2 4 .	. . 4 4

Two cases with senile depression were operated on. One of them recovered from his depression, but showed progressive dementia with marked personality changes as seen after leucotomy and also in senile dementia. The other case made a very good remission and has kept well for 4 years, apart from a short period of mild depression of 2 months' duration a year after leucotomy.

A case of senile mania, operated on in 1944, relapsed 2 years after the operation, but her manic symptom had been less severe than before leucotomy and did not call for readmission to hospital. She has recently shown early signs of dementia.

The assessment of various grades of "absolute" results in cases of the affective reaction types would be unprofitable at this stage, for reasons outlined above. However, it may be worth noting that if the criteria proposed for the assessment of absolute results were applied to this group of 77 patients, 5 male cases (3 involutional and 2 recurrent depressions) and 9 female cases (3 involutional, 3 recurrent depressions and 3 manic-depressive) would qualify for a "very good" absolute result.

Eight patients, i.e. about 10 per cent. of the living patients with affective reaction types, followed up by interview, were in hospital at the time of the re-examination. The 5 involutional cases still in hospital had been operated on at the age of 69, 63, 55, 52, and 47 respectively; only in one of these cases had the duration of the illness before leucotomy exceeded 4 years. Of the remaining 3 cases in hospital, 2 (aged 39 and 61 on operation) were manic-depressives, predominantly manic, who had been ill almost without remission for 15 and 18 years respectively; the third was a case of recurrent depression, operated on at the age of 47 in her fourth attack which had set in 2 years previously.

From the data available no consistent features common to most of the failures emerged. Marked hypochondriacal symptoms had been noted in only

Depressive Reactions.

B. predominantly depressive.)

Level of work of disch. patients.									In hospital.			Dementing.			Antisocial personality change.							
Same.			Lower.			None.																
M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.					
A.																						
..	2	2	.	1	1	2	.	4	..	4	.	1	1	2	.	1	..	1	.	3	1	4
B.																						
2	5	7	.	4	..	4	.	3	..	3	.	..	..	..	.	..	..	..	.	2	1	3

tional Depression.

Level of work of disch. patients.									In hospital.			Dementing.			Marked antisocial personality changes.						
Same.			Lower.			None.															
M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.				
1	11	12	.	1	6	7	7	2	9	.	1	4	5	.	2	..	2	.	5	4	9

3 of the cases still in hospital. Delusions had been observed also in 3 of the 8 cases in which the operation did not alter the clinical picture. Hypochondriasis and delusions had been present in a considerable number of patients who had made a full remission or had improved. The average age on operation of the patients still in hospital was about the same as in the group of affective reaction types as a whole.

Personality changes.—In only 5 cases did the follow-up examination fail to reveal features of the well-known personality changes following frontal lobe lesions. However, this number has to be reduced by 2 if those patients are excluded whose relatives stated that since the operation they had been better than ever before. This statement invariably reflected the disappearance of such habitual personality features as oversensitiveness, moodiness and obsessionalism, which are so often found in those suffering from attacks of depressive illness. In these cases the personality change resulting from leucotomy had led to a modification of premorbid traits, which was regarded by the relatives as a permanent gain. Similar statements were recorded in 8 other cases where definite, though mild, personality changes could be established. Only 3 cases remain, therefore, in which no personality changes were found. Changes were present to a varying degree in all the others, and were no doubt responsible for the frequent decline in working capacity (see below). In a number of cases undesirable personality features of an antisocial nature made their appearance, such as complete lack of consideration for others, increased irritability and aggressiveness, and a decline of moral standards. However, only one patient committed a criminal offence. The patient was a man of 37, with manic-depressive periods, predominantly manic; he had a history of psychopathic personality features. His illness started at the age of 31. He left, against advice, a month following the operation and was, 2 months later, jailed, having been convicted for fraud to the amount of £60. This was

alleged to have been his first conviction. Antisocial features were not observed to any marked degree in cases where the illness had been one of pure depression. They were observed in patients who, in the course of their depression, had shown marked aggressive tendencies directed against the outside world, and in patients who, in addition to their depressions, had had manic attacks, and in the case of recurrent mania mentioned above. Tables XIII, XIV and XV demonstrate the correlation between these clinical features and this type of personality change.

In 4 cases an interesting new behaviour pattern had emerged after the operation. These patients showed marked instability and restlessness, which expressed itself in an urge to make unnecessary journeys every day. A male patient travelled almost daily to a town 20 miles away to have lunch and attend the cinema there; these journeys ate up his small capital. A female patient was continually changing her domicile and travelling abroad, which she had not done before. Two other patients travelled unnecessarily several miles to another town to do their shopping. Among the discharged schizophrenic patients this feature was found in one case only. Each of the patients in question admitted that the journeys were quite unnecessary, and that in making them they were giving way to an urge to move about.

Of the 8 patients in hospital at the time of the follow-up, 3 had been operated on in 1947, 3 in 1945, and 2 in 1943. Two of the patients operated on in 1945 (both cases of involutional depression) had been at home for a period: the one whose conduct had not changed materially was readmitted after 11 months at home, while the other had relapsed 2 years after the operation.

Work.—The number of patients in this group who, following the operation, took up work at the same level as before the illness or the last attack was very small (see Tables XIII to XV). Of the 5 male patients whose standard of work was not lower than before, 4 were unskilled workers and one a business man who, after his recovery, even increased his status and income. A considerable number of patients worked on a lower level than before their illness. The female patients were almost invariably housewives, of whom the majority were able to carry on as before. The comparatively large proportion of unoccupied men was at least partly due to age, some having retired before the operation, while others, being elderly, did not succeed in finding work. In the majority of these cases the personality change following the operation was no doubt responsible for their inability to find work and to re-establish themselves as useful members of the community.

Periodicity.—In only 2 cases had there been a regular periodicity prior to the attack during which the operation was carried out. One was a male patient, aged 57 at the time of the operation, the second a female patient aged 44. Both of them, prior to their last attack, had had over many years periods of depression lasting for several months annually. In neither case have these attacks recurred since the operation. The first case, however, has, since the operation, had short periods of depression lasting for about a week, at more or less monthly intervals ("fragmentation"); in this case the last attack, which had led to the operation, had been much longer and more severe than the previous ones. The second patient has been entirely free from relapses so far. In all the

other cases of recurrent illness the interval had varied in duration, and no conclusions could be drawn as to the effect of the operation on the tendency to recurrence.

Dementia.—Four cases (aged 61, 63, 67 and 70 respectively at the time of operation) showed marked signs of dementia similar to those observed in senile dementia. These cases had not been stated to be demented prior to the operation. One was a case of chronic depressive illness of many years' standing, 2 were involutional, and 1 a case of senile depression. In 3 of the cases the depression had subsided following the operation.

Cases followed up by correspondence.—Five cases (1 senile and 4 involutional, depressions) could be followed up by correspondence only. The senile patient was improved, but apparently dementing. Of the 4 others, 3 appeared to have undergone a full remission, while one was said to be slightly improved.

Deaths.—Thirteen patients (3 male, 10 female) died following the operation; 8 were cases of involutional depression, 3 of recurrent depression, 2 of manic-depressive illness; their average age was 53.

Five died within 2 months, and 3 within one month of the operation (one following a second leucotomy). Five of these 8 cases were involutional depressives; their average age on operation was 54. In 6 of these cases cerebral haemorrhage was the cause of death (in 4 the blood pressure had been high); one had been suffering from diabetes mellitus and one had shown signs of general arteriosclerosis. One patient died of purulent meningitis. In one case, where death occurred a month after the operation, an abscess of the lung, a subdural haematoma in the middle cranial fossa and a softening in the medulla were found.

In 5 cases there was no indication of any direct relation between the operation and death. One patient, having recovered from a severe depression following operation, died 9 months later of tuberculosis of the lungs, which had probably precipitated her depression. One died of coronary thrombosis 6 months after the operation; he had shown signs of generalized arteriosclerosis. One patient died of cancer of the bowel 2 years after the operation, and one from cancer of the uterus 3 years later. One patient died 14 months after leucotomy, probably from a late cerebral haemorrhage; in this case the blood pressure had been normal.

OTHER CONDITIONS.

The number of patients operated on who did not belong to either the schizophrenic paranoid or affective reaction types was small, and does not permit any conclusions to be drawn as to the indications for the operation or its effect on the conditions treated.

Obsessional illness.—Five patients (2 male and 3 female) were operated on for obsessional neurosis. In 2 of them anxiety symptoms were very marked. Both these cases were assessed as full remissions; in one of them, however, the degree of improvement could not be established beyond doubt because the patient refused to see the psychiatrist. The remaining 3 cases, which belonged to the classical type of obsessional neurosis, responded less satisfactorily; 2

could be classified as improved, while the third was unchanged, according to his relatives, and worse in his own judgment.

The two patients classified as full remissions were housewives who maintained a good standard of work following the operation. Of the remaining three, the one who had not improved, a skilled workman, continued at the same level of work as before the operation, the second was working on a lower level than before, but not continuously, while the third case, a female patient, aged 35, who had been working in her mother's household before the operation, is now training on a poultry farm.

There were 2 other cases with severe obsessional symptoms of long standing, but both had shown definite schizophrenic features. They have been listed among the schizophrenics. In neither case did the operation effect a change; one died in the course of electronarcosis treatment 2 years after the operation.

Except for one of the 2 cases showing a full remission, all patients of this group showed personality changes of various degrees.

Anxiety states.—Only one patient, aged 35, was operated on. He had been suffering from a long-standing chronic anxiety neurosis with hypochondriacal symptoms. The operation effected a full remission with only slight personality changes. The patient has not so far succeeded in re-establishing himself professionally. Prior to the operation he had done clerical and insurance work; having failed in both, he has now, 3 years after the operation, decided to take up agricultural training.

Psychopathic personalities.—The operation was carried out in 6 cases of psychopathic personality with hysterical and hypochondriacal features. In 1 case a full remission ensued, 1 is much improved, 2 are improved, and 2 unchanged. One of the 2 unimproved patients was still in hospital; 3 of the others were working at their previous level and 2 at a lower level. Four of these 5 are working in unskilled occupations, while one is a business man who has maintained his standard of work and even improved his standing in his firm.

In addition, 2 patients who had been alcoholics and had developed a hallucinatory psychosis were operated on. They recovered from their psychotic state following the operation, and have refrained from excessive drinking so far, i.e. over a period of 2 and 4 years respectively. Both are unskilled workmen whose work records following the operation have been satisfactory.

Mental defectives.—Four cases of high-grade mental deficiency with aggressive and antisocial behaviour were operated on. One of them was an active homosexual. He was drowned in his bath in an epileptic fit 2 years after the operation. The other 3 are still in hospital. They had failed to improve, and one of them was even more difficult to manage than before the operation.

Mental deficiency with epilepsy.—Two imbeciles and one low-grade mental defective with frequent epileptic fits since childhood had been operated on. They had shown aggressive-destructive behaviour over many years. In one of the imbeciles there was some improvement of conduct and he had had fewer fits since the operation, the other had become even more aggressive

than before the operation ; the idiot has remained fundamentally unchanged, though he is somewhat easier to manage.

Post-encephalitic personality disorder.—Two male patients, both aged 35, had been operated on. They were both high-grade defectives. The one, who had an encephalitis lethargica at the age of 10, and was free from neurological symptoms but suffering from impulsive outbursts, did not improve. The other patient, who had marked Parkinsonian symptoms, had been less aggressive following the operation, but otherwise his physical and mental condition remained unchanged.

An early case of *Huntington's chorea*, accompanied by a schizophrenic-like psychosis with delusions and catatonic features, improved greatly from the psychiatric point of view, following leucotomy, while the neurological symptoms have progressed rapidly.

The operation had practically no effect in a youth of 18 who had developed a profound organic dementia with extreme restlessness following an illness diagnosed as *Schilder's disease* at the age of 12.

SECOND OPERATIONS.

Five of the cases under review were subjected to a second operation before the end of 1947. Three of them were deteriorated schizophrenics, one was a case of chronic depression, and the fifth was the case diagnosed as *Schilder's disease*. The case of depression died from cerebral haemorrhage 7 weeks following the re-operation. The case of *Schilder's disease* remained unchanged. Two of the schizophrenics showed improvement of conduct, while the third schizophrenic remained unchanged.

POST-LEUCOTOMY EPILEPSY.

Thirty-six (11.0 per cent.) of the 327 non-epileptic patients operated on have had at least one epileptic fit at some time following the operation. Table XVI shows the number of patients with epileptic manifestations, relative to

TABLE XVI.—*Post-leucotomy Epileptic Attacks Among 327 Patients.*

Year of first oper.	Numbers of first oper.	Second oper.	Cases with ep. attacks.			Percentage of cases _A
			M.	F.	T.	
1942	7	..	1	..	1	14
1943	41	1	3	4	7	17
1944	84	..	7	1	8	9.5
1945	92	..	8	5	13	14.1
1946	62	2	2	5	7	11
1947	41	2	..	..	..	..
Totals	327	5	21	15	36	11

the number of operations carried out during each year under survey. If those cases are excluded whose fits can be regarded as caused solely by traumatic

irritation due to the operation, the number of patients with post-leucotomy epilepsy is reduced by at least 5, which would give a percentage of about 9.4.

The average age of the patients with post-leucotomy epileptic fits was 43 for the female and 39 for the male cases.

None of the patients operated on in 1947 has so far had an epileptic fit.

Table XVII analyses the material according to sex and illness. It demonstrates the following facts: (a) A considerably higher proportion of male

TABLE XVII.—36 Cases of Post-leucotomy Epilepsy.

Year of operation.	Schiz. and par.			Affective reaction types.			Others.		
	M.	F.	T.	M.	F.	T.	M.	F.	T.
1942	1	..	1	..	..	..	..	..	..
1943	2	3	5	1	1	2	..	..	..
1944	5	..	5	..	1	1	2	..	2
1945	5	3	8	3	2	5	..	..	..
1946	2	5	7	..	..	..	..	..	..
1947	..	..	..	..	..	..	..	..	..
Totals . . .	15	11	26	4	4	8	2	..	2
Number of previously non-epileptic cases followed up . . .	94	115	209	35	60	95	12	11	23
Percentage of cases with post-leucotomy epilepsy . . .	16.0	9.6	12.4	11.4	6.7	8.4	16.7	..	8.7

cases had epileptic fits. (b) The percentage of schizophrenic and paranoid patients who, some time after the operation, had epileptic fits was markedly greater than that of patients with affective reaction types. The lowest proportion of epileptic fits was found among female affective psychoses. (c) All the patients who had epileptic fits more than 3 years after the operation belonged to the schizophrenic reaction types and paranoid states. This means that the proneness to late post-leucotomy epileptic fits was, in this material, greater in schizophrenics and paranoids than in cases with affective psychoses. There was no correlation between different schizophrenic and paranoid reaction types on the one hand and the occurrence of epileptic fits on the other hand: 7 of the 26 cases of that group belonged to the catatonic, 8 to the hebephrenic reaction types, 4 had been diagnosed as paranoid schizophrenia, 6 as paraphrenia, and 1 as senile paranoid state. Two of the hebephrenics and 2 of the paranoid schizophrenics had at times shown catatonic features.

Table XVIII analyses the cases according to the period which had elapsed between the operation and the first fit, and according to the number of fits. It shows that half of the cases had had only one fit so far by the time of the re-examination, and a quarter of the cases not more than 5 fits altogether. It also shows that only in a minority of cases had the first fit occurred within 6 months of the operation, while in some it occurred 3, 4 or 5 years later. None

of the patients whose fits occurred more than 3 years after the operation belonged to the affective reaction types. They were all schizophrenic and paranoid reaction types, except for one with minor fits who was a case of obsessional neurosis.

TABLE XVIII.—36 Cases of Post-leucotomy Epilepsy Analysed according to Number of Fits and to Periods within which the First Fit Occurred.

Number of fits.	2 weeks.	6 months.	1 year.	2 years.	3 years.	4 years.	5 years.	Totals.
1	3	1	9	1	3	1	..	18
2 to 5	1	..	3	2	1	..	2	9
over 5	1	3	2	3	..	..	..	9
Totals	5	4	14	6	4	1	2	36

The fact that the first epileptic fit often occurs more than a year after the operation may at least partly explain the absence of fits among the patients operated on in 1947. Possibly some will have fits later. There are probably other factors which also contributed to the absence of fits in this group. Among those operated on in 1947 the proportion of schizophrenics was considerably smaller than in the previous years and a greater proportion of them were females. Among the affective psychoses, too, the females far outnumber the males operated on during that year. As post-leucotomy epileptic fits appear to be most frequent in male schizophrenics and paranoids, and least frequent in female affectives, a low incidence of such fits was to be expected in the 1947 group. Also, the majority of patients operated on in 1947 are still in hospital, where they are given phenobarbitone as a routine. Many discharged patients tend to ignore the advice to take the drug, or fail to take it regularly.

Table XIX demonstrates the occurrence of fits in individual cases, the relation of the fits to the operation, their numbers and spacing. The dots signify the dates of the operations. The figures refer to the number of fits which had occurred during each quarter year. In 5 cases (Nos. 4, 6, 22, 24, 25) the closeness of the figure to the dot indicates that the fit occurred within 2 weeks following the operation.

The following particulars concerning the fits are of interest :

Case 8 had all the fits within a week preceding her death from septicaemia and nephritis. There was no status epilepticus.

Case 15 was drowned in his bath in a major attack.

In Cases 16 and 34 the fits were *petit mal* attacks.

In Case 18 a series of 9 spontaneous fits occurred in the course of cardiazol treatment ; 3 fits occurred 3 months later.

Case 23 died from cerebral haemorrhage a month following the first and only fit.

Case 24 had an isolated fit 6 days after the first leucotomy, but no fit followed the second operation.

TABLE XIX.—*Post-leucotomy Epilepsy in 36 Cases.*

The chart demonstrates the number of fits and their relationship to the operation in each case. Each square represents a quarter of a year. The numbers indicate the number of fits within a quarter. The dots indicate the dates of operations. The second dots, in Cases 24 and 34, represent second operations. (In cases 4, 6, 24 and 25, the figures indicating fits had, for technical reasons to be put before instead of closely after the dots.)

Case No.	1942	1943	1944	1945	1946	1947	1948
1	.					I	I
2	.				I		
3	.		I				
4		12.					
5		.	I	I	I	I	I
6		2.					
7		.	I				
8		.		2I			
9			.			I	
10			.				2
11			. 5	3	2 3 4	3 4	2 4
12			.		5		
13			.	I			
14			.	3			
15			.		3 4 2		
16			.				3
17			.			I	
18			.		9 3		
19			.	I			
20			.		I		
21			.		I		
22			. I				
23			.			I I	
24				I.	.		
25				I.			
26				.	6	16	8
27				.	I		
28				.		5	
29				.		I	I
30				.			I
31				.	2		
32				.			I
33				.		I	
34				.		I	.
35				.			I
36				.		I	

Case 25 had a Jacksonian fit on the day of the operation.

Case 28 had a series of 5 fits in the course of insulin coma treatment, but not in the hypoglycaemic state.

Case 29 had her first fit in October, 1946, and the second in January, 1948. She had a course of intensive electro-convulsant therapy in December, 1946; she had been without spontaneous fits for 13 months following that treatment.

Case 27 was the father of Case 21. The latter, a hebephrenic, had a major fit 11 days, the former, diagnosed as involutional depression, 7 months after operation.

The number of cases is too small to allow any conclusions to be drawn as to a possible correlation between the incidence of epileptic fits and the degree of improvement, but the following figures may be of interest. Of those with epileptic fits 16 had left hospital, 17 were still in hospital, and 3 were dead; they represented 11 per cent., 12.5 per cent. and 8.8 per cent. of the totals discharged, in hospital and dead respectively. Of the 16 discharged, 6 were classified as full remissions, 2 as much improved, 5 as improved, and 3 as unchanged. Of the 17 in hospital, 15 were unchanged, 1 improved, and 1 worse.

Eleven patients, including the 2 who had died, had had more than 2 attacks. One of these, who was much improved, had 12 attacks within 2 weeks of the operation and 1, classified as a full remission, had only a short series consisting of 3 fits. The remaining 9 cases showed no material change in their clinical condition. In this material, therefore, there was an inverse correlation between the degrees of improvement and the number of fits. Of the 11 cases with more than 2 fits, 7 belonged to the schizophrenic and paranoid groups. Three (Cases 5, 8, 11) were catatonics.

It is noteworthy that none of the patients who had epileptic fits within 2 weeks after the operation (Cases 4, 6, 22, 24, 25) had further fits later. This suggests that in these cases the fits were solely due to traumatic irritation caused by the operation. The same probably applies to fits occurring within a few months of the operation. In the rest of the cases the fits were obviously due to scar formation. One is, therefore, justified in distinguishing two groups of epileptic attacks following leucotomy: (*a*) those due to the acute operational trauma, and (*b*) those due to scar formation. It is difficult to draw the line between the two groups within the first few months following the operation.

Agencies which tend to increase the state of cerebral irritation were apt to lead to fits or to increase their frequency, but this does not apply generally. While in some cases spontaneous fits occurred for the first time and only during the course of insulin or convulsant therapy, in the intervals between treatments, many leucotomized patients had shock treatment which did not give rise to fits. This is illustrated by Case 29: the patient had an isolated fit following the operation, but intensive E.C.T., 2 months later, failed to elicit spontaneous fits; she had one more isolated fit more than a year after this treatment.

Among the 5 cases which had a second leucotomy during the period under review, no epileptic fits were observed following the operation, not even in a patient (No. 24) who had had an isolated fit 6 weeks after the first operation.

The second leucotomy was, in this case, carried out almost exactly a year after the first.

It may sometimes be impossible to decide whether or not epileptic attacks occurring after leucotomy are related to the operation. Therefore a schizophrenic patient who died in a status epilepticus in insulin coma, 13 months after operation, but who had had no epileptic fits previously, has not been included among those with post-leucotomy epilepsy. However, it is not unlikely that the leucotomy scar acted as a predisposing factor in this case.

All patients operated on, with only a few exceptions, had at some time before operation had convulsant therapy. It was therefore not possible to correlate the occurrence of post-leucotomy epilepsy with previous shock treatments.

No conclusions can be drawn from this case material as to why epileptic fits occur in some cases and not in others. The problem appears to be the same as in other types of brain injury. No electroencephalographic studies were carried out in the case material presented here, and nothing can be said about the role of predisposition to epilepsy in the origin of these fits. However, the occurrence of isolated fits in father and son mentioned above is noteworthy.

The question has been investigated whether certain personality features, such as increased aggressiveness and irritability, were more frequent among patients with post-leucotomy fits than in others. No such correlation has been found in this case material.

COMMENTS.

This follow-up investigation has been confined to the clinical re-examination of patients operated on during a period of more than 5 years. The majority of the cases had been operated on during the war and the early post-war period, when psychiatrists working in mental hospitals had to be satisfied with establishing the salient clinical facts only. A survey such as this, though necessarily lacking in depth, is nevertheless useful for the study of the broad clinical aspects of a therapy. In many respects this follow-up investigation has corroborated observations made by other workers, especially concerning the schizophrenic and paranoid reaction types. It is not intended to compare the results of this study with those reported by others or to discuss the literature. Some of the observations presented here, such as those pertaining to the modifications of affective reaction types after leucotomy, to the correlation between certain clinical features and the post-leucotomy personality changes, and to the epileptic manifestations following the operation, have not been reported before, and require confirmation by other investigators.

The limitations of leucotomy in the treatment of schizophrenic reaction types and paranoid states have again been demonstrated. Full remissions have been observed mainly in cases which showed features in their personalities and in their mental conditions which are generally regarded as assets from the point of view of prognosis. There is still no general consensus of opinion whether or not such cases should be operated on. The final decision on this point should depend on whether leucotomy can prevent or delay progress of the illness and relapses. So far no proof has been forthcoming that it can, and

therefore the indication for leucotomy in these cases is questionable. However, when it comes to assessing the chances of remission in an individual case, opinions, even of experienced psychiatrists, differ. None of the patients of this series would have been operated on if the likelihood of a good remission had been deemed to exist. Retrospectively, it is impossible to judge what would have been the fate of the patients who made a full remission following leucotomy if they had not had the operation. That the remission was in these cases related to the operation was clear from the fact that leucotomy was followed by immediate or almost immediate improvement. Leucotomy, therefore, set in motion a process which might or might not have taken place without it. Whether the remissions obtained by leucotomy are of a better quality and durability than spontaneous remissions or those following other methods of treatment, it is impossible to judge at present. The relative results of the operation in the rest of the schizophrenias and the paranoid states were satisfactory in a considerable proportion of cases, though material improvement was, in this series, observed less frequently than by some other workers.

The modification of affective states by leucotomy, whether by mitigation or fragmentation, is worthy of interest. The mitigating effect on recurrent attacks is in keeping with what is known about the lowering of the level of emotional tension resulting from this treatment. The phenomenon of fragmentation may be attributable to the same mechanism which reduces the ability of the individual to remain on a stable level of emotional tension for prolonged periods.

Among the various affective reaction types the results have been relatively most satisfactory in the involutional group, while the effect of the treatment on cases with manic periods has been less favourable. The outcomes in patients with purely depressive symptoms, i.e. in the recurrent and the involutional depressions, were more favourable than in those with manic periods. Partridge (1949) has arrived at a similar conclusion. On the whole, this survey does not suggest that a drastic revision of the indications for leucotomy in affective states, which has so far been restricted to the involutional group and to cases of recurrent depressions without or with only very brief remissions, is called for.

No reference to the exact location of the cuts in individual cases has been made in this paper. Mr. A. G. Ross has, like Freeman and Watts, attempted to vary the planes of the cuts according to the suggestions of the psychiatrists. In certain cases an "anterior" cut was aimed at, in others a "middle" or "posterior" cut, the latter especially in those cases where general behaviour was gravely disturbed, as in chronic catatonics. However, in view of the anatomical findings in the brains of patients who died some time after leucotomy, an attempt at correlating clinical changes with the location of the cuts aimed at by the surgeon seems futile. The brains of those among this material who died from intercurrent illnesses have been examined by Meyer and his co-workers. They formed part of his material which demonstrated a bewildering variety of final anatomical results of leucotomy, and the absence of a consistent correlation between the actual location of the damage and that intended by the surgeon. Meyer and McLardy (1948) have found that per-

sonality changes, especially apathy and restlessness, tend to be severest in cases with widespread lesions of the posterior parts of the prefrontal areas. In discussing personality changes attributable to the operation, some authors expressed the opinion that they depended mainly on the location of the damage, while others stressed the relationship to previous personality features. A final solution of this problem can only be expected from a study of a series of cases in which full clinical and personality studies, as well as anatomical investigations, are available. So far no such series has been reported.

Certain personality changes, especially those related to psychomotor behaviour, seem to be related to location and extent of the lesion. But clinical observation strongly suggests that other traits, especially those affecting social behaviour, are intimately related to the premorbid personality. In a number of cases of this material marked antisocial tendencies, which emerged after the operation, appeared to be related to traits which had been present to a smaller degree before the illness, and in several instances the patients' relatives spontaneously remarked on that relationship. This investigation also confirmed the impression of other workers that personality changes concerning social behaviour are less marked in previously well-adjusted subjects, provided the personality has not suffered disintegration as the result of the illness.

The post-operative personality changes in the affective reaction types also suggested a correlation between certain features in the mental disorder and certain post-operative personality changes. Antisocial behaviour following leucotomy was much more frequent in those cases where manic symptoms had been present before the operation, and where aggressive thought contents and behaviour directed against the environment had coloured the depression, even where no such antisocial features had been present before. Such personality changes may therefore be related either to premorbid antisocial traits, or to manic and aggressive features which formed part of an affective mental disorder. Possibly this is the case because these features themselves are the expression of a constitutional tendency to disinhibition which leucotomy in many cases seems to accentuate. One may speculate whether the personality structure which allows of manic disinhibition is not inferior to one in which this does not happen, and whether there does not exist some fundamental constitutional difference, as far as personality structure is concerned, between affective reaction types with, and those without, manic symptoms and externalized aggressive tendencies.

Among the patients who died from intercurrent illnesses 2 groups are of special interest. The first comprises the 3 patients who died as the result of shock treatments administered a considerable time after the operation. This may have been purely accidental, but the possibility cannot be excluded that these deaths were due to impairment through frontal lobe lesion of certain autonomic mechanisms. This would apply especially to the two cases who failed to recover consciousness from therapeutically induced coma. The second group are the 5 cases who died from tuberculosis. In only one had the illness been known to be active at the time of the operation. In this case it was hoped that leucotomy would, by removing the symptoms of an agitated

depression, help to arrest the tuberculous process. Although in these 5 cases the periods which had elapsed since the operation had been considerably longer than in cases of "delayed post-operative death," described by Meyer and McLardy (1948), it is not unlikely that in these patients leucotomy had resulted in a reduced resistance of the organism. These observations make a large-scale systematic study of morbidity and mortality rates among leucotomized patients appear highly desirable.

Further studies on a large series of cases will also be required to assess the significance of post-leucotomy epileptic manifestations in general, and their correlation with sex and type of mental illness in particular. Post-leucotomy epilepsy has, in this survey, been found much more frequently in patients with schizophrenic and paranoid reaction types than in those with affective states. This is of interest in view of findings of abnormal electroencephalograms typical or suggestive of epilepsy in schizophrenics. Denis Hill (1949) has recently reported observations on this subject and reviewed the literature. Owing to the absence of electroencephalographic investigations in this series it is not possible to say whether such abnormalities had been present in the cases with post-leucotomy epilepsy. The incidence of epileptic manifestations among the whole material was about similar to that reported by Greenblatt *et al.* (1947). The occurrence, in some cases, of the first epileptic fit as late as 5 years following operation has also been observed by Freeman (1949).

SUMMARY.

The results of a follow-up investigation of 330 cases treated with pre-frontal leucotomy are reported.

The types of cases in which the mental disorder took a favourable course following the operation are discussed.

Modifications of affective reaction types following leucotomy are described. The effect of the operation on recurrence and periodicity is discussed.

The emergence and aggravation of antisocial personality features following leucotomy in patients with affective reaction types has been found to depend not only on the previous personality, but also on certain features of the mental disorder. Such changes have been observed especially in those patients who had, in the course of their depressions, shown aggressive tendencies directed against the environment and who had had manic periods.

The occurrence and frequency of post-leucotomy epileptic manifestations has been studied. In the material surveyed, epileptic fits had occurred in a higher percentage of male than of female patients. A considerably higher percentage of schizophrenic and paranoid patients had epileptic fits than of patients with affective reaction types. The possible significance of this discrepancy is discussed.

Among the causes of death from intercurrent conditions, coma treatment and tuberculosis have been specially commented on.

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ILLUSION OR ILLUMINATION: A STUDY OF THE RELIGIOUS PROCESS.*

By W. J. T. KIMBER, M.R.C.S., L.R.C.P., D.P.M.

THERE are few, I suppose, who would disagree with the view that we are passing through a period of social and cultural disintegration.

The claims of society are disregarded by a large number of its members, and customs hallowed by age-long observance are passing rapidly into disuse. Almost daily, science throws increasing light on fresh problems of the hour, while religion is eclipsed and increasingly disregarded, so much so that we see it stated that the loss of Christian faith and philosophy is due to a conviction that science has replaced it.

Science, or reason, it is claimed on the other hand, cannot walk by its own light, but needs some principle of interpretation beyond itself (1).

That the present position is far from satisfactory is generally agreed. We are faced with a disturbing increase in the amount of juvenile delinquency and of crime generally, and this is held by many to be due in part at least to a lack of spiritual understanding and religious training. We seem to have lost something of value or something possibly even essential, if we are to progress as a world civilization.

Here then is a situation provocative of thought. It seems to be a matter of moment, a matter of urgency, and although I am but poorly qualified to deal with it, there is here a challenge which as psychiatrists, I feel we cannot properly avoid.

"Religious doctrines" (I am quoting Freud) (2) "cannot be proved or refuted, but are so improbable so incompatible with all we have discovered about the reality of the world as to be almost delusions." He passes on to explain that religion has lost the influence it once had, "not because it promises less, but because its promises are less credible," and he concludes that even the fundamental assumptions of religion are being discredited.

Though such an opinion as this may not be acceptable without modification by psychologists to-day, it does represent still the general attitude of many of those of the lay public who think at all about such things, and it encourages a complete disregard of the subject by many others.

Emil Brunner in the Gifford Lecture of 1947 throws some further light on the reasons for the development of somewhat similar opinions when he says "The detachment of culture from Christianity produced the fatally erroneous belief that culture or creativity needs no subordination to a higher unit, but

* Presidential Address to the Section of Psychiatry, Royal Society of Medicine, delivered 8 November, 1949.

can live on its own resources. The vehemence with which the so-called Christian tutelage of culture is rejected is not incomprehensible, considering how intolerably in past centuries Christianity has fettered culture. The narrow borderlines in which Church dogma kept scientific endeavour hampered scientific development for 'centuries' (3).

Jung also has warned us of the danger of reaction here, though he states the problem rather differently, as follows : " If we are conscious of the spirit of the age, we should know why we are so inclined to account for things on physical grounds ; we should know that up till now, too much was accounted for in terms of the spirit. This realization would make us critical of our bias."

Our present attempts to give physical explanation, he likens to a development of consciousness on the horizontal plane, as opposed to and in consequence of the " exclusively vertical perspective of the Gothic age."

Looking about us on the horizontal plane at our fellow men and women we shall certainly discover a reality and will inevitably give it a material interpretation, but may we not glance upwards and by interrupting our world-fast inspection shall we not gain a clearer vision of reality, in appreciating a greater unity?

Some comprehension of this greater unity is only to be gained by relating the vertical with the horizontal aspect, by relating material objectivity with that something more which we may call spiritual reality, and as the Russian philosopher Berdyaev has pointed out, the present day materialistic domination of life is due to " a divorce between spirituality and the complete life " (4.)

As professed healers of the mentally sick, do we not owe a duty to our patients to consider the " complete life " ? Because of their unfamiliarity and the impossibility of measuring up by a scientific yardstick, the spiritual aspects of life expressed in religious concepts and dogmas, we as psychiatrists are not justified in disregarding or underestimating their importance.

The Churches in our Western Culture at any rate, are the organizations concerned with the presentation of the spiritual to man. To-day the credit of the Churches probably stands in the popular estimation on an even lower level than that of " religion " itself. It will help if we give some thought as to the reasons for this, for we shall thus better understand the difficulties which the Churches—or in fact any other form of organized religion—have to meet. We shall find that indeed the Church is open to the same criticism and for the same reasons as we have heard applied to the scientific world.

The task of the Church is to relate spiritual truth from " above "—to continue using spatial metaphors—to the horizontal vision of the ordinary man engaged in daily conflict with the realities of a material universe. For this purpose various techniques are employed, and in the words of Berdyaev there is consequently and necessarily an " objectification of spirit."

" The wind bloweth where it listeth "—so is everyone that is born of the Spirit—but as soon as the spirit is objectified in church organization, as symbol or ritual, it is no longer free, it is limited, restricted and controlled by the fetters of dogma and tradition.

This limiting factor, which characterizes objectification of spirit in religion, was clearly apprehended by Jung, and is referred to by him as the " walls

erected in primeval times" (5), from behind which it is stated a religious tyranny can never again be exercised over mankind. They serve, however, we must remember, a beneficent purpose, being the means by which the unlimited and uncontrolled spirit was made available to materialistically-minded man, who, according to his individual capacity, could receive more or less of the things of the spirit. It would seem from the signs of present social unrest, that further training is needed before man for the most part will learn to become sufficiently responsible to use even the limited degrees of freedom which is being thrust upon him. "But to train a people in the way of democracy after centuries of despotism is a hard undertaking," writes Dr. Barnes, Bishop of Birmingham, and continues: "There must be something in the nature of religious dedication before it comes to pass that a man, conscious of more than ordinary ability, will put aside ambition to rule others and place his gifts at the service of his fellow-men. . . . The danger to democracy is that men who achieve leadership should be so fearful of revolution, so obsessed by the need for order, that they suppress freedom. Tyranny is the more dangerous in proportion as the motives which lead to it have justification" (6).

It is not surprising, therefore, that organized religion should have found it necessary to limit freedom and so objectify spirit in the way that it has done. It shows to what extent the position has been misunderstood since scientific criticism of religion has for the most part been levelled at it on these grounds.

The limiting factor in the spiritual field manifests itself in the formulation of differing creeds, particular rituals or peculiar symbols. Differences in formulation appear since man familiarizes himself with one known way in his insecurity and is only too ready to affirm that this is the only way, hence different religions and differing sects appear and multiply. To how great an extent the adoption of a particular religious outlook is influenced by the psychological make-up has been pointed out by David Yellowlees (7) and other writers.

In the scientific sphere the limiting factor appears as a narrow specialism, carried on with little or no regard to work being done in other fields. Whitehead terms this the "dogmatic fallacy." The error, he states, "consists in the persuasion that we are capable of producing notions, which are adequately defined in respect to the complexity of their relationship required for their illustration in the real world." "Our right understanding of the methods of intellectual progress depends on keeping in mind this characteristic of our thoughts. The notions employed in every systematic topic require enlightenment from the perspective of every standpoint. They must be criticized from the standpoint of their own internal consistency within the topic and from the standpoint of other topics of analogous generality, and from the standpoint of so-called philosophic topics of a wider range."

"During the medieval epoch in Europe," he adds, "the theologians were the chief sinners in respect to dogmatic finality. During the last three centuries their bad pre-eminence in this habit passed to the men of science" (8).

The work of Carl Jung demonstrates very clearly that his technique at least has not suffered from this defect and from a study of this we may hope to gain some deeper insight into these problems. His appreciation of the comprehensiveness of the factors involved in the integration of personality remind

us of the humility with which any worker in this field should approach his task. For the achievement of personality he writes : "A whole human life-span in all its biological, social and spiritual aspects is needed. . . . Personality is an act of the greatest courage in the face of life, and means *unconditional* affirmation of *all* that constitutes the individual. . . ." (9). There is no limiting factor operative here.

We cannot hope to reach any indication much less understanding of the reality or otherwise of the spiritual factors influencing behaviour unless we take pains to consider what we may loosely term religion and to distinguish between, on the one hand, the essential elements of it—that spiritual apprehension of truth which "makes one free," and on the other, those accretions, those objectifications which bind, confine and may ultimately lead to religious antagonisms and isolation.

William James, you will remember, designates as "over-beliefs" the various different interpretations of religion, while contending that some sort of "over-belief" is a practical necessity for the individual (10). The over-belief is capable of almost indefinite variation and adaptation to the needs of the individual and of the age. Over-beliefs thus became dated, and so out of date. As new needs arise they fail to supply that satisfaction which a former generation sought and found in them. Their very vitality, their capacity to linger on, seems to be due not to their transient characteristics, but to some intrinsic and essential quality derived from their timeless and spiritual origin.

We can see that much of the criticism to which religion is subjected to-day arises from a failure to recognize the difference between the transient, finite nature of the over-beliefs and the eternal and infinite character of spiritual creativity. It is clear, however, from what has been said that over-beliefs are humanly constructed and adapted structures, the response to man's immediate needs and insecurities, and although this has not always been recognized by religious leaders, their "human, all too human" origin has been conclusively demonstrated by anthropologists and psychologists. It would, indeed, be no exaggeration to say that credibility in accepting many over-beliefs is by any modern standards simply incredible.

If we remain unaware of the limiting factor and fail to penetrate beyond it, when considering any ideas, it is astonishing how restricting and stultifying its effects may be. We must at all costs strive to avoid this and take the greatest care to relate our ideas in any one field to those of seekers in others. Reality is reality for a subject, an individual. For most people to-day even scientific reality is not *adequately* related to the experiences of their daily lives, it is accepted as something of a mystery, a magic. So it is also with religion. Science, however, is applied, it works to an extent that is not true of religion, because religion is still hampered by the limiting factor from which science has broken free. There is a need, it would seem, for the application of religion to our daily problems, but we have yet to exorcise the limiting factor. It is the beam which we have not cast out from our eyes ; it not only clouds our vision and distorts our reason, but makes us emotionally inaccessible and intolerant ; it limits our power of co-operation and practical ability. It is, perhaps, the very Devil.

While it would be difficult and, I think, not very fruitful for our present purpose to try and determine the line dividing belief and the over-beliefs, we must give some consideration to the basic characteristics of belief.

A study of the beginnings of religion and its early development throws much light on this. From the earliest days man has used religion to provide for his really vital needs and to acquire for himself that security which in his weakness he so earnestly desired. The deep feelings associated with these needs have been constantly expressed from primitive times till the present day, in the form of myth and ritual. Even in their primitive form, these show recurring themes expressive of the turning of the individual to the non-material and the development of some sort of spiritual relationship with what appeared to be "beyond." Professor E. O. James, writing of these primitive religious cults says, "If at this stage ritual dominates the situation this is only because the deepest emotions of the human heart, and the most profound convictions of the mind find expression in actions before they are given utterances in words and elaborated in systematized theologies and philosophies, aetiological mythologies, spiritualized worship and ethical rules of conduct" (11).

This being so we shall feel no surprise at finding ritual ceremonial expressive of this primitive need for spiritual relationship perpetuated and conserved, or reappearing with but little modification as forms of worship in the higher religions at the present time.

The breaking of bread and participation in a communal meal is an instance of such a perpetuated ritual. In this connection we may note how the basic spiritual symbolism of communion with the diety has in the Christian worship become associated with the teaching that it was so ordained by Christ. Recently this assumption has been challenged by Dr. Barnes (12), but whether this is historically correct or not, its acceptance may be looked upon as a matter of concern as regards the over-belief and not as invalidating the spiritual value of the ritual, which long antedated its sanction—if so it was—by Christ.

Psychology has dealt with these human expressions or symbolization of the spiritual and has concluded that they are subject to human and natural laws of development. It would indeed be strange if this were not so. The spiritual itself, however, is a category beyond the assessment of psychology, and conclusions about the material representation of the spiritual are in no sense valid in regard to the actual nature of the spiritual itself.

A study of comparative religion has made it clear that many of the rites of the Christian Church have a close counterpart in those of earlier religious rituals. Many Christians who believed that their own practice rested on a divinely ordained origin, in an historical setting, the teaching indeed of the over-belief, were perplexed and despondent in consequence.

It would seem, however, that what at one time was regarded as merely primitive superstition has had in fact the elements of the spiritual within it.

Those, for instance, who accept the gospel narrative, may thus regard the value of the communion rite as enhanced by its antiquity and by the fact—if the gospel record is acceptable as historically accurate—that its value as a sacrament was appreciated and used by Christ as a vehicle of continuing spiritual relationship.

This takes us on to a consideration of what characterizes the expression of the spiritual which is common to all the higher religions, and of which we can find traces even in more primitive forms. What evidence is there of such universal spiritual reality ?

If we want to be sure about the existence of anything in the material world, we can go and see it for ourselves, but it is otherwise, Freud suggests, as regards spiritual realities. We are required to take them on trust. Such an accusation, however, can hardly be sustained, since many people, at different times, with differing religious convictions have sought and obtained a first-hand experience of what they felt assured was spiritual reality. They have had to undertake however, without exception, an arduous, sometime dangerous spiritual journey in order to do so. They have only gained the experience at a price.

These are the mystics who, in all lands and throughout all time, in humility and self-abandonment, poor in spirit, have sought and found this spiritual reality, which they have recognized as something transcending self, that something which they have often called God. They have been and seen and have attempted to pass on to us something, but admittedly and very definitely proclaimed by them to be, not more than a mere shadow of the actual experience.

The mystics have done much to illuminate and cleanse the religion of their day by setting out in terms appropriate to their time and culture something of the ultimately inexpressible and incomprehensible nature of their individual mystical experience.

There exists a tendency to some confusion between mysticism and magic, and while we need not now enlarge on the nature of the differences we do well to remember the essential difference. This is put tritely and pertinently by Evelyn Underhill : " The fundamental difference between the two is this : magic wants to get, mysticism wants to give " (13).

We may be inclined to dismiss mysticism as something if not definitely morbid, at least as so trivial as to be beneath serious consideration. We are indeed likely to do so unless we distinguish between its essential nature and its accidental and consequential trappings. Words are admittedly an inadequate means for giving expression to the mystical experiences, and symbolism is varied in attempts the more adequately to express them. The greatest mystics are unanimous in emphasizing the inadequacy of expressing the " Ineffable Reality," they make a clear distinction between the two. The expression is consequential, but not essential to the experience itself. The path of the mystic is not an easy one. It entails an autognosis—self-analysis—which may well result in much personality disturbance. Morbid reactions and neurotic manifestations may be observed. It is doubtful, however, if we are justified in regarding as really pathological, these non-essential manifestations of the individual's struggle to attain relationship with the Absolute or at least no more so than the pain and physical disorders, which so often have been the lot of explorers, exposed to risks of climate and country in expeditions of discovery in new lands.

We must here attempt some further definition of mysticism and give some consideration to the mystical process or behaviour pattern. Evelyn Underhill (14) has defined mysticism as " the name of that *organic process* which involves

the perfect consummation of the Love of God, or it is the *art* of his conscious relation with the Absolute." Passing over William James' four marks of the mystic state (15) as unsatisfactory, she substitutes for these four tests which I give in a somewhat abbreviated form as follows :

1. Mysticism is active and practical. It is an organic life process involving the whole self, not merely an intellectual opinion.
2. Its aims are transcendental and spiritual, and it is not concerned with action in the visible universe. It does not imply neglect of duty to others, but it implies a constant setting of the heart on the One.
3. The One is never merely an object of exploration, but exists as Reality, but is also a living personal Object of Love.
4. Living Union with the One—the mystic aim—is a form of enhanced life, it entails intellectual realization and emotional longings, but requires through an arduous psychological and spiritual process—the Mystic Way—the liberation of a latent consciousness resulting ultimately in the attainment of the Unitive State.

We should note here that although mysticism is concerned with a fuller understanding of the One, in order through greater love to be as it were burnt up and consumed in the unitive existence with the Absolute, its active and practical side is emphasized, while its organic activity is regarded as essential.

"All mystics speak the same language, for they all come from the same country" says St. Martin. There is a unanimity amongst them as to their mystical experiences, which confirms belief in the reality of the states to which they testify, and as to the conclusions they have reached as to the origin of such experience. It is in this way that the mystical experience differs from the morbid intellectual and emotional activities of the neurotic or psychotic subject. We find, moreover, that their spiritual experiences have not diminished the capacity of the mystics in the practical aspects of life. Many of them have exercised a profound influence for good on their generation, while a few were efficient administrators and conducted their affairs with a soundness of judgment and a clearness of vision which are the very antithesis of morbidity.

The mystic way of life has then a dual aspect, comprising both an effective relationship with transcendent reality, and also with the needs of the material world which involves communion and love for one's fellows and consequently a desire to bring them to at least some realization of the richness and splendour of the mystic way. Not all mystics, of course, have shown to the full these dual characteristics. Some have been introverts and recluses, who have to a very limited extent been able to communicate with their fellow men. It is clear, however, that the mystic life is in no way a hindrance, but rather a help to a fuller community relationship. It is essentially a beneficent rather than a malignant influence, it brings together rather than isolates.

Although it is pre-eminently through the mystics that spiritual insight of divine revelation has come, there are two other classes of individuals to whose behaviour patterns we must also give some attention, since it is, I believe, more fruitful to study living reacting individuals, since on such lines we are

more likely to get an appreciation of the dynamic force which religion claims to be, than we are by attempting a critical analysis of its dogmas which are but reflections of living thoughts and feelings. It was by such means that Freud developed the dynamic concepts of psychoanalysis, which have proved so fruitful in making clear to us psychopathology to-day.

We must then consider the rôles of the prophet and the priest in the course of religious development.

The Hebrew race has produced a series of prophets with spiritual insight and an appreciation of spiritual values and reality the like of which have been seen in no other race. The Hebrew prophets spoke as God, they spoke for God and told forth what they felt, and asserted to be the opinions and intentions of Jehovah. They were men of their age and had a very definite and usually a very specific message for their time and place.

Their message, being founded on lasting values, was found to have a more general and even timeless application. Judged by present day standards many of their ideas were primitive, but they persist and influence and indeed enrich our concepts even to-day. As Abraham quoted by Elmslie (16) says : " It is primitive to think of God as close at hand, speaking to Moses face to face as a man to his fellow ; it is primitive to place God in a local heaven above the earth, for science has left us no room for any divine seat in the skies. Yet these two primitive ideas in interaction gave us in Judaism, on the one hand, the immanent God, and on the other the transcendent."

The great prophets, each in turn, as Elmslie has demonstrated, set out in their day for the first time " one cardinal principle of belief concerning Supernatural Reality and the consequent nature of human duty." They were, in fact, true mystics exemplifying the dual characteristics of the spiritual and material aspects of life, but for the most part they stressed a special aspect of this relationship, Amos with mercy, Hosea with love, Isaiah with the eternal in the temporal, and so on.

The priest also is concerned with both the spiritual and the physical world. He is essentially the intermediary between God and man, but his particular concern is with the average man who is not specially endowed with spiritual insight. By his teaching and ministrations, largely symbolic in character, he attempts to bridge the gap between the spiritual and the material. He uses ritual and sacramental actions as a sign but also as a means for doing this. He speaks with and is endowed with authority, but is himself under a pledge to carry out his duties in accordance with carefully prescribed rules. He may be spiritually-minded and have considerable mystical insight, but being controlled and directed he is denied that freedom which is the privilege of the true mystic.

He is essentially a conservator and preserves forms and traditions which at one time were newly discovered and vital expressions of immediate spiritual life. In course of time, however, all such tend to lose their freshness and their value as a source of power and inspiration. When this happens a feeling of insecurity results and additional means are sought to bolster up a ritual which has lost its vital force and immediate appeal.

In consequence of this, myths and rituals which originally had a deeply

spiritual significance and application become contaminated and debased, so that thinking people may discard them.

When a rite from whatever cause loses its spiritual significance, but its use is persisted in, it becomes little more than a magic formula for compelling the god to accede to the demands of the worshipper. It is a regressive phenomenon partaking of the nature of the primitive magic of the witch doctor. It then loses not only its spiritual, but even its ethical value. Opponents of religion have with justification pointed this out, but they have gone further and have found in these imperfections and perversions a warrant for wholesale condemnation of religious practices.

These, however, are not the only difficulties with which the priest has to contend. He has to relate God to men, but to men in very different stages of spiritual, intellectual and emotional maturity. Attempts to meet these differing needs are the occasion of still further aspersions on the bona-fides of the Church. What is acceptable and intelligible and emotionally satisfying only in a symbolic form to one cultural group, appears to another section to be mere superstition, spiritually undesirable or even misleading.

These difficulties are not only not considered by the critics, but are often quite unrealized by the faithful themselves, who being unaware of the baneful effects of the "limiting factor" condemn those who do not conform to their own narrow tenets.

Most of us, as regards the spiritual life, are like the infant, ignorant and ineffective. It is, Adler claims, to the urge for superiority, to a wish fulfilment, that our material progress is due, and so it is on the spiritual plane. We wish to be better, we seek peace and security, but in doing so face the spiritual paradox that this entails sacrifice of the self. A desire to do the will of God, because it is pleasing so to do, and for love of him, replaces the self-seeking impulses.

The primitive acquisitive urge for love and security on a crude wish fulfilment level, is transmuted into the mystical desire to give oneself in love and self-abandonment to the Divine and thus directed in its highest forms issues as an increasing awareness of social claims and a feeling of responsibility for others.

This is not a specifically Christian doctrine but is common to all the higher religions. "Hear, Israel, the Lord is our God, the Lord is One," but also "Thou shalt love thy neighbour as thyself."

The Gita teaches the Hindu the complementary nature of devotion, knowledge and action. "By meditation some perceive . . . others by the path of knowledge, and still others by the path of works" (17).

The immanent in relation to the transcendent, the self (individual) as a manifestation of the Self (absolute), the soul in association with God, seeks expression in a practical way, in a material universe of other human beings, as part of the process of its spiritual fulfilment. Thus religion in seeking as an ultimate aim, relationship of the individual with God, has an intermediate effect of the greatest practical importance, in stimulating a better, that is a more considerate, relationship of one man with another. It seems to involve a process, a kind of background adjusting mechanism, which is of the greatest

practical value to mankind and can therefore in no sense be regarded as an illusory phenomenon.

"The way" is hard and we must not be surprised to find many examples of failure amongst those endeavouring to follow it, but it would be illogical to regard these as characteristic of the religious life. We may find the fear of being challenged on points of doctrine issuing in heresy hunting in extreme forms, the need to find scapegoats for guilt feelings, may show itself in untrained persecution. We may see excessive puritanism, over-compensating for a covert worldliness, and other such examples of failure to maintain an exacting standard of conduct, but we are no more justified in making a judgment on religion, on such grounds than we should be in assessing the worth of chemistry on the efforts of a class of children in a school laboratory.

Is it possible to describe in psychological terms these processes which we have so far termed spiritual or religious? They appear to be effective in making man better able to grapple with the varied problems of life, and we should therefore like to consider them from a psychological angle. It is undoubtedly to Jung that we shall turn for help here, for in the archetypes which he has made known to us, beyond the bounds of any individual experience, in the collective unconscious are to be found, in symbolic and primitive forms, evidence of those deepest and earliest feelings of man which seem to partake of the nature of the spiritual.

Freud has emphasized the universal tendency, particularly if early life has been a series of experiences of threats and frustrations, to regress and to secure early satisfaction and security in wish fulfilments. Jung has shown how this process may proceed still further back into the collective unconscious and final security can only be found in a retreat to the omnipotent father archetype, or even to the still more primitive mother symbol.

While it is true such a retreat may end in continued fantasy activity and permanent inhibition of personality development, the libido being morbidly sequestered, a process termed by Jung "inversion," on the other hand, there may be a rejuvenation and re-animation of the inward-turned libido which issues in creative activities of many kinds. The latter is a wholly beneficent process, termed by Jung "introversion."

In mythology the inward turning of the libido is portrayed as the descent into the underworld, that is, it is concerned with the collective not the individual unconscious.

Listen to Mephistopheles instructing Faust as to how to find there the maternal archetype.

"In solitude throne goddesses sublime,
Round them no place is, and still less a time
Only to speak of them the brain doth swim . . .
.
And round them float forms of all things that be
They'll see thee not, for wraiths alone they see.
Then pluck a heart up for the dangers great."

and later

"I wonder now if ever he'll come back."

That is, will there be merely an inversion of libido with a fantasy mother fixation and no possibility of return to the world of light and life, or will the descent result in an augmentation of libido and a return from the shadows to the world of men? Will the process be one of introversion, through which the psyche having tapped the archetypal source of power and wisdom, reinforced and spiritually reborn, returns to meet the problems of life with increased power and greater spiritual awareness?

"The essential problem of human consciousness hinges upon the basic condition that man has to adapt to two relatively incompatible psychical realities"—I am quoting Baynes (18). "The roots of his emotional life in the primordial or impersonal psyche, on the one hand, provide an access, so to say, to the eternal verities, while above in the running stream of time, the constantly changing flux of events and conditions makes a perpetual demand for adaptation and improvisation."

The weakness of the Christian religion, as compared with many Eastern cults, lies in its great reliance on faith and its very limited provision of instruction whereby its adherents can gain access to the eternal verities. This position is made still more difficult by the importance that has been placed on the time and place elements as regards the life of Christ—its historicity—whereas it is his spiritual essence which is of primary value, since this partakes of the eternal. Though the essential nature of the fact of the incarnation—the relation of the eternal to the temporal—may be admitted, no such essential qualities attach to the local and temporal details of such an event. The acceptance or repudiation as matters of belief of historical details are of the nature of an over-belief. Christianity would become much more credible, and therefore a much more effective force in men's lives, if such problems of time and place were left to be settled by critical historical methods.

The gospel story of the resurrection, historically considered, is one full of contradictions, uncertainties, and improbabilities to such an extent that for many people it is incredible, but, writes Dr. Barnes, "The resurrection is one of the great essential truths of Christianity. But it cannot be stated too often, or too emphatically, that this tenet of the Christian faith is quite independent of the question as to whether the body of Jesus was re-animated after his death. What matters is that Christians shall find a spiritual power in their lives, which they can rightly interpret as that of the Spirit of Jesus revealing, as in his teaching in Galilee, the wisdom and righteousness of God" (19).

Mythologically the story of the death and resurrection of Christ runs on more or less classical lines and as a symbolic presentation is of value as doctrine if recognised as such.

Spiritually Christ died and rose again and his spirit of love and self-sacrifice influenced his disciples and their adherents so that it was said with astonishment, "How these Christians love one another!" How powerful in the lives of these people was the effect of their introversion and how wide was their subsequent influence in the world.

It is by the process of introversion that heaven and earth have been united in an emotionally adequate and so satisfying and effective way.

We saw previously when considering the development of the myth from

primitive times how later additions, intended in the first instance as supports, led finally to a devaluation and devitalization of the living forceful myth. If doctrine based on the myth is to live again and have a value for a later more sophisticated generation, it must be purged of these later accretions.

The re-animated spirit or libido following introversion would then be free for creative work instead of being dissipated in argument and disputes over unessential details of historical accuracy.

It is not, however, possible to express such teaching in an emotionally acceptable way in scientific terminology nor even in the language of Western theology. Attempts to do so stultify themselves by producing monstrosities of bewildering and unconvincing verbiage. Eastern philosophies are more adequate, but symbolism and myth have always been the best media available for the purpose, though ambiguities and misinterpretations are then in the nature of things inevitable. Ultimately it must be recognized that one cannot explore "the unexplorable."

The very real advances science has made by providing man with such a wealth of mechanical contrivances for dominating the material universe, has indirectly also contributed to man's spiritual asthenia. He appears to be no longer subservient and inferior to nature and the gods of nature, but seems actually to be in control and dominant.

While on the material plane this is to a great extent true, there appears to have been no corresponding spiritual development. God appears to have gone the way of the old gods, but man alone is clearly unable to cope with the situation. He is full of pride in achievement, which according to the theologians, is the first of the deadly sins, and only, we are told, in a return to spiritual humility recognizing the omnipotence of the Spirit is there hope for him, that by a process of introversion, finding by way of the collective unconscious, some of the ancient God-given wisdom, he will ensure a return and rebirth in power, to control those material forces for constructive rather than destructive ends.

It is this element of power and forcefulness which Professor Toynbee emphasizes in his analysis of the growths of civilizations (20). He refers to the whole process as the Movement of Withdrawal and Return—an appropriate designation for such a creative process—and he quotes a graphically realistic description of this by Bergson as it is seen in the mystics (21).

"The soul of the great mystic does not come to a halt at the (mystical) ecstasy as though that were the end of the journey. The ecstasy may indeed be called a state of repose, but it is the repose of a locomotive standing in a station under steam pressure, with its movement continuing as a stationary throbbing, while it waits for the moment to make a new leap forward. . . . Henceforward the soul has a superabundance of life ; it has an immense élan, it has an irresistible thrust which hurls it into vast enterprises."

Listen to the words of the Hebrew prophet, "I will go before thee and make the crooked places straight ; I will break in pieces the gates of brass and cut in sunder the bars of iron ; and I will give thee treasures of darkness and hidden riches of secret places, that thou mayest know that I, the Lord which call thee by thy name, am the God of Israel."

This power and effectiveness is based on the mystic experience of love and sacrifice. "This monk can give lessons to lovers" was said of St. John of the Cross.

The mystic returns enlightened and invigorated to find in the world a love and intimacy with all creatures, and a power and effectiveness through which he can realize his *duty to man and God*.

In the Collective Unconscious we find something of a personal nature. The Unconscious personates, says Jung, and it is in this sense that we may hope to understand the personal nature of the Christian God, in no sense as a bodily restricted, anthropomorphic being, but yet the source of a directed spiritual force, the effects of which we may observe and analyse in an individual's conduct.

Seen in this way we may get some understanding of what is entailed in the God-man relationship. In religion it is this *relationship* which is vital. Belief on an intellectual and rational level apart from this is "nothing worth," but realization of the love of God "passeth all understanding."

One has to proceed along the way and learn step by step to love in this manner, just as the student of art or the sciences has to proceed along the accepted paths advancing little by little in his chosen field.

A lack of moral and religious upbringing has been held responsible for the great increase in crime, and particularly in juvenile delinquency. Is there justification for this?

One has to learn to love, and the broken home, the distracted mother, the care-ridden father, do not provide a suitable environment for learning this lesson.

Susan Isaacs noted as a fact of the deepest significance "the reality and power of the super-ego in the early years." This she held to be an innate attribute of the child's mind, but she stressed the need for relating this fantasy super-ego of the oral-sadistic pattern, with parents and other adults, who can control and direct to such an extent that the super-ego is not called upon to inflict severe self-punishment.

Where there is a satisfactory love relationship the parents are endowed by the child with ideal attributes which many fail to justify, but the child's rich fantasy life transcends their actual failings to a large extent and maintains intact the ideal controlling, supporting and directing parent figures.

Religious training in the early years again through fantasy and symbolism provides alternative or additional parent figures which because they are dependent for their formation on compensatory mechanisms, and are endowed with qualities lacking in the actual parents, may well prove fully satisfying. We may describe this happening in various ways, saying, for instance, that the primitive super-ego is projected in fantasy and a divine father figure formed, or that the individual ego is thus related to the archetype or alternatively that the intrinsic and spontaneous spirit imminent in the child self or soul is united with the transcendent SELF or deity.

However this may be verbalized, it seems to be an entirely beneficent activity, which gives to those children who have learnt to symbolize and so vitalize and perpetuate the relationship in the practice of religion an added

measure of comfort, support and confidence. It provides them with an additional measure of stability which enhances their capacity to meet the challenges and threats of life. They attain a greater measure of mental health.

Religious training should be related to the demands of the reality situation and it would appear to be desirable to relate this training, or at least to understand the relationship between religious development and the early social adaptations that a child is expected to make. There must be, I think, an appropriate advancing spiritual stage related to the oral, anal and phallic phases of child development. The solution of the Oedipus situation has surely a spiritual counterpart.

Progressive development of religious ideas during the latency period would, I believe, go far to equip the individual to meet the storms and stresses of puberty and adolescence. It is surely a lack of this preparation—religion as a background in life—which is a factor in bringing so many children in their later years to the Juvenile Courts and the Child Guidance Clinics.

The difficulties in the way of the child deprived of parents or in a "broken home" or similar situation, becomes at once apparent as adequate parent figures on which to develop a spiritual relationship for life are lacking, and though the need for religious guidance is greater under these circumstances, the opportunities for obtaining it are for many reasons less.

In the earlier stages of child development there is, of course, no possibility of an intellectual approach, all is experienced as feeling, and the need for the mother to be the first love-object is one which in most cases is adequately met. Though this condition persists, at the same time also from about the end of the first year of life onwards the child develops an intellectual appreciation and awareness of others and of their claims.

Even for adults we have seen that the verbalized and intellectual expression of the mystical experience is well-nigh impossible, we should therefore be prepared to utilize the normal fantasy constructions of the child for helping to relate him not only to the material realities, but to the higher spiritual values which seem to be essential for the fuller life.

Persons and conditions to-day, as indeed has always been the case, do not offer to the child patterns of perfection, but the ancient wisdom has provided these—symbols of the divine and the eternal—in forms which childish fantasy can assimilate and manipulate. To-day, however, the traditional teachings have been so far discredited that neither in the home nor in the schools is there much chance that really living and vitalizing spiritual or religious training will influence the child consistently. Many of those who have had some religious instruction perceive the symbols only without apprehending the spirit behind them, and as such they soon prove to be meaningless and useless.

Too many children, as they reach adolescence, if any religion is left in them, retain it in an infantile form, which with an extension of secondary education and with a wider learning in science and history they are unable to reconcile with what they have been taught of the physical world. Their religion is a poor tenuous wraith of a thing, certainly utterly useless for "breaking in sunder bars of iron."

No wonder they jettison it as an encumbrance. They are without judgment or experience to guide them, whereas opportunities for action are multiplied, and adolescent drives, often artificially stimulated in numerous ways, produce only too often the kind of problems with which we are all familiar.

To a large extent I have referred to religion in a rather general way without specifically considering Christianity. I have dealt with the religious process as observed in different types of individuals, and have noted some of the consequences of the absence of such a process. I have been concerned with what is common to religions as they have developed, that is, with what may be called "natural religion." It is this type of religion which Kierkegaard has termed Religion A, and referred to as the "religiosity of immanence." To this extent, he maintained, truth could be realized by an individual's inwardly directed thought. It is essentially anthropocentric, God being recognized and approached through the individual personality. According to Kierkegaard, Religion A must pre-exist in an individual before the more fully developed Religion B which he equates with Christianity can be acceptable.

If this be so, we see here as in other developmental processes an ontogenetic repetition of religious phylogenesis. Furthermore, Kierkegaard allows that Christianity is too severe and demanding a religion for children. They require some modification of the full teaching. St. Paul, indeed, recognized this as a necessity for all converts, who at first must be fed with "milk and not with meat," but becoming more advanced spiritually need more sustaining truth for their satisfaction.

Progress as viewed by Kierkegaard comprises a series of choices of which the most vital one is the final "leap of faith" which he emphasizes must be always a solitary and individual undertaking, a definite personal choice.

This is the leap from the ascertainable immanent and natural religion, which is subject to rational laws and deductions, to the transcendent eternity. It involves leaving and renouncing everything temporal; here again we have a description of the withdrawal, but paradoxically, in so doing there is acquired—on the return—all the radiance and illumination of the eternal. This then is faith, which, having the quality of an absolute relationship cannot be taught or directly communicated by one person to another. Science stops short of this. Is it illusion or illumination?

As psychologists we may shrug our shoulders and leave the matter unresolved, but as psychiatrists, physicians of the sick, we must, I submit, go further. Medicine embraces art as well as science, and for many it has and still does partake of the spiritual in that their practice is the outward expression of this.

We would not judge medicine by the claims of the quack medicine vendors nor should we appraise religion by the less enlightened claims made on its behalf. Many outstanding figures in the religious life have shown a high degree of social adaptation and ability and have been realists in the material sense, and to suggest that the basis of such activities are to be found in illusory ideas seem to me impertinent and unrealistic. If from the evidence available we find a spiritual orientation is subjectively a factor of value in guiding the lives of our patients, it should surely be regarded as reality and endorsed as such.

To sum up, we may think of man as at the same time within three fields or spheres of influence or relatedness, which together constitute his environment. From each of these the individual gains some protection or support in meeting the demands which life makes upon him, and he therefore needs to develop his ties with each of these throughout life.

This is, of course, particularly important in the earlier years and education for life, as opposed to training to earn a living, should be an aid to this end. Deprivation of an essential requirement so often demonstrates its functional value, and in the child deprived of any religious upbringing, lacking any cultural background, and without experience of a loving and integrated family life, we see, I think, the serious effects of such deprivation. Many such children are characteristically unstable, impulsive, rootless, and seem almost incapable of developing any lasting ties of affection.

I see the individual surrounded throughout life in a sphere of immediate personal experience, constituting the situation of the moment. This is built up of the present material or sensible factors constituting his world situation. Here also are stored past individual experiences, happy and invigorating memories, psychic traumata and a medley of experiences remembered, half-remembered and forgotten.

There is also, but concealed—only to become manifest under special circumstances—the material of the racial or collective unconscious, the archetypes, symbols of the earliest and most primitive human heritage.

These two spheres have received scientific recognition as the Conscious and the Unconscious.

But beyond this—what? There is no human beyond. Only in transcending humanity have some found evidence of the source of existence, the ultimate creative power, the Godhead.

This third sphere, the spiritual or transcendent, is not assessable by any scientific measure and has received as yet no scientific sanction. Claims that the power derived from such a source has dynamic effects on human conduct are impressive. The evidence cannot lightly be disregarded. The effects are of a kind which go beyond anything which is undoubtedly of human derivation. Since it is the opinion of many intelligent and unbiased persons that such forces are, as reality, daily influencing their lives, it would not be unreasonable to term them ultra-conscious.

Actions originating in the ultra-conscious are characteristically integrating and unifying. They are other-worldly to the extent that they are related rather to the eternal and the infinite, than to time and place. Religion teaches that such may characterize human as well as divine activity, and since we are not in a position to refute such a claim, we may gain further insight into human conduct if we accept the concept of the ultra-conscious as a working hypothesis.

Many of us will remember the opposition and the difficulties encountered in gaining acceptance for the Freudian unconscious, but its usefulness as a hypothesis has established it as scientifically acceptable.

The Ultra-conscious may be defined as that part of the mind comprising feelings, intuitions and apprehensions which receive spiritual influences from without. Here they are retained and integrated with other collective and

individual unconscious contents and forming a background directive issue in the drives of the individual life.

We understand conduct in relation to unconscious motivations in a way which renders it comprehensible. Similarly, I submit we can the better understand conduct if we can relate actions not only to the conscious and unconscious, but through these to the ultra-conscious factors, which under many conditions influence individual behaviour in an otherwise inexplicable way.

As long as we are under an obligation to repudiate spiritual or ultra-conscious influences, we are forced to explain much conduct of a high ethical order in a way which to many seems improbable if not absurd, but by recognizing the ultra-conscious to be as real as the conscious and unconscious, many of our difficulties are resolved.

As scientists we shall thus acquire a better understanding of those who, not concerning themselves, with scientific theory, have made the "leap of faith" and have through the process of introversion undergone the final change of conversion.

In this, as Kierkegaard states, is the Paradox which characterizes as does nothing else, spiritual conversion: "Whosoever shall lose his life for my sake, shall find it."

The truly spiritual man will meet all the tests. Dr. Torrie, speaking recently on "Mental Health in the Community" reminded us of the statement that "life is meeting," and that this requires us to discard the garments of office, status and position. The spiritual man has no need for such garments. He may use them in deference to convention and as an indication to others, but he is ready, indeed eager, to relinquish them, since in each and every individual he recognizes the spiritual of like nature with his own. Differences of culture, race or colour become then of little significance.

"We must look perhaps for the leader within," Dr. Torrie remarks. Unquestionably we must, and in so doing the spiritual man will find within himself, a reflection of the spiritual light in the ultra-conscious, from which he may acquire understanding and responsibility for his conduct and in self-sacrifice and humility in relation to God gain self-confidence and self-reliance in regard to his fellows. A paradox indeed.

Judged by strictly scientific and materialistic standards, that is from the rational conscious field alone the limiting factor, the things of the spiritual world can but appear as illusions, but seen from the viewpoint of those who have made the leap, that is, looked at from the ultra-conscious sphere, such things are indeed radiant with unfading illumination.

Does this appear to be an evasion of the issue? I hope not, but let me put it thus.

From a scientific viewpoint we must restrict ourselves to what can be observed and assessed in general terms. We introduce, wisely enough, a limiting factor and confine ourselves to the bounds of the conscious and unconscious. We thus reach certain conclusions, rationally deduced which are applicable within the specified limits.

As psychiatrists we deal not with the general, but with individual per-

sonalities—a unique relationship. In this situation we become aware of something more, something which I have called the ultra-conscious. We then may realize as our own personal experience that the following words from Sir Thomas Browne's *Religio Medici* have to-day an immediate and vital meaning.

“There is surely a piece of Divinity in us, something that was before the Elements and owes no homage unto the Sun. Nature tells me I am the Image of God, as well as Scripture ; he that understands not thus much, hath not his introduction or first lesson, and is yet to begin the Alphabet of Man.”

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CONGENITAL MALFORMATIONS IN THE TEETH AND EYES IN MENTAL DEFECTIVES.

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THE interest in developmental abnormalities and their aetiology has considerably increased in recent years. In spite of this, there is a paucity of information about congenital anomalies of the teeth and about their association with similar lesions in other parts of the body.

The present paper deals with dental malformations as part of a syndrome comprising other congenital lesions, and mental deficiency.

Dental dystrophies are due to various causes acting in the pre- or post-natal period, and the deformities are variable in extent and degree. Most of the clinical and experimental work deals with the effects of post-natal environmental factors on the tooth structure, and the study of the aetiology of the congenital dental lesions has been relatively neglected (Moore, 1944).

The enamel of the tooth, the lens of the eye and the nervous tissue are among others, derivatives of the ectodermal layer. It is well known that various clinical syndromes may arise in one or several of these structures from faulty development. This may be due either to a primary lesion in the embryonic layer or to an interference with the developmental process early in foetal life. An example of the former is hereditary ectodermal dysplasia, a rare condition characterized by defects in one or several organs arising from the ectoderm. The dental manifestations are malformations of the tooth structure and partial or complete anodontia. The example of the latter aetiology is congenital syphilis, where the lesions of the permanent teeth can be pathognomonic. The enamel deficiency is present before the eruption of the teeth as observed by histological and radiological observations (Sarnat and Schour, 1941; Bauer, 1944). The present investigation was carried out to find whether dental malformations can be related to the pathology of the endogenous mental disease. A further problem studied was the incidence of developmental lens defects in these patients. This was done to see whether such changes would support the argument that the causative agent or agents are partly or wholly synergistic.

The assumption that congenital syndromes can often be reduced to ectodermal, mesodermal and entodermal lesions, has in recent years been questioned. In its place has been suggested a classification based on biochemical (enzymatic) affinities (Grüneberg, 1947). The present work, however, is to some extent based on the first mentioned hypothesis which, whatever its demerits, has not proved unfruitful, since the biochemical affinities probably correspond to a

certain extent with the histological and is still affirmed by many authors (Boyd, 1943; Bruno and Engelhardt, 1944).

In this paper abnormalities of the permanent teeth only are considered. The permanent teeth erupting six or more years after the factors of any maldevelopment have ceased to act, still exhibit the characteristic pattern of the maldevelopment. There are other congenital or inherited diseases whose clinical manifestations are only seen years after birth, e.g. retinitis pigmentosa, Friedreich's ataxia, etc. (Grüneberg, 1947).

In varying degrees other congenital systemic diseases, in addition to those previously mentioned, may provoke structural anomalies of the dentition.

In the last few years maternal rubella has been identified as a cause of congenital malformations in the child (Gregg, 1941; Swan, Tostevin *et al.*, 1943, 1946), and since then evidence has accumulated to confirm these observations. The effects on the child are most marked in cases where the mother contracted the disease between the sixth to ninth week of pregnancy. Evans (1944, 1947) was the first to describe the developmental defects in the deciduous teeth in this condition. His findings indicate a close aetiological relationship between the dental defects, and the other congenital lesions such as cataract, deaf-mutism, microcephaly, mental deficiency resulting from the systemic infection. They are, furthermore, an attempt to correlate the dental changes with the clinical history and to assess the time of exposure to the injurious agent within narrow limits.

More information has been collected about tooth anomalies associated with congenital lesions of the skin, and some of it has to be mentioned briefly. Cockayne (1933) reviews the whole question and points to various forms of dental maldevelopment in this condition, e.g. enamel hypoplasia, microdontia, partial or complete anodontia and delayed dentition. He also discusses their association with lens changes and mental defects. His views are substantiated by many other authors (Halperin and Curtis, 1942; Bruno and Engelhardt, 1944; Andrews, 1946; and Sequeira, Ingram and Brain, 1947), and from the data submitted there is sufficient evidence to state that the unusual dental features are due to the same early developmental or germinal deficiency which also produces the other defects.

Consequently, we can see that a single pathological aetiology, not only may provoke changes in tooth, skin and lens, but, in addition, mental deficiency.

As far as one of us (R. S.) is aware, no large-scale inquiry has been made into this question. Tredgold (1947) remarks on the high incidence of dental disorders in various groups of mental defectives, especially in the presence of a palatal deformity. Of particular interest are the reports on dental anomalies in mongolism. Tooth lesions in this condition were recognized by Jones (1890), quoted by Brousseau (1928). Kreyenberg (1936), van der Scheer (1927), Thomas (1939) and Benda (1947) have, among others, also noted the frequent occurrence of various forms of dental dystrophies, such as hypoplasia, malformed teeth, microdontia, anodontia and delayed eruption.

This survey has shown that there are instances where the tooth anomalies assume significance as part of the clinical syndrome.

In some of the mentioned systemic diseases the associated dental lesions

are clearly not due to genetic causes, but to foetal damage (congenital syphilis, maternal rubella). If dental anomalies are found in patients affected with genetically inherited diseases, it is necessary to examine whether these tooth defects are also genetically determined or are due to other factors.

The significance of this point is obvious. Snyder (1941) and more recently Gates (1946), have recognized that the dental tissues in their undifferentiated state are subjected to genetical influences. However, since the dental stigmata are not characteristic enough to indicate the aetiology, it may be of help to look for related changes in other parts of the body. The findings can then be used as a guide in clarifying the problem.

Previous investigations of the occurrence of dental lesions in mental patients have not attempted to differentiate these defects into groups, and did not segregate the cases with dental and other developmental anomalies from those without these conditions.

A high incidence of hypoplasia of the tooth enamel in idiopathic epilepsy has previously been reported (Spitzer, 1933, 1942). The present paper deals with a larger number of patients, and the investigation was not confined to cases of idiopathic epilepsy, but included mongols and unclassified mental deficient patients in order to find the incidence of dental defects in such inborn cerebral diseases and to trace the connection with congenital lesions in other organs of ectodermal origin.

There were two important reasons for selecting mental cases for this purpose. Firstly, among such cases there are many whose aetiology is known to be genetical, producing pre-natal lesions in other organs; and secondly, the tooth enamel shares with the nervous system its origin from the ectodermal layer.

The present study aims to clarify the following points:

1. Which dental anomalies can be considered congenital.
2. The incidence of dental lesions among all three groups of mental defectives examined:
 - (a) Idiopathic epilepsy.
 - (b) Mongolism.
 - (c) Unclassified mental deficiency.
3. The incidence of dental and lenticular lesions within these three groups.
4. The incidence of associated dental and lenticular lesions within each of these groups.

CLINICAL FINDINGS.

Two-hundred and thirty patients in Leavesden Hospital and 89 patients in the Fountain Hospital were examined. The examination was augmented by checking the history of each patient, including his family history, in order to trace genetic and acquired influences.

Eighty-three of the patients in Leavesden Hospital had their eyes examined by Professor Ida Mann. They were divided into two groups, one with dental lesions, and the other without, but both having the same mental disease.

Only those cases showing bilateral lesions of the teeth were considered positive. Where the contralateral tooth was missing or did not permit of a

definite diagnosis, or where the condition was not sufficiently marked, the case was classified as doubtful.

Three different types of dental disorders were noted :

1. Enamel hypoplasia.
2. Malformation of shape, the outstanding features of which are either the shortening of the transverse axis, producing long and narrow teeth, or the loss of the normal incisal edge, producing peg-shaped teeth.
3. Microdontia.

All patients were excluded whose mental condition was obviously the result of birth injuries, trauma in early infancy or congenital syphilis.

Among the 83 cases who were examined dentally and ophthalmologically, the ages of the imbeciles ranged from 24 to 47, of the mongols from 21 to 43, and of the idiopathic epileptics from 19 to 64.

Enamel hypoplasia was present in all three types, though the highest incidence was in idiopathic epileptics and imbeciles. Malformed, peg-shaped teeth and microdontia were most prevalent in mongols.

The 230 cases in Leavesden Hospital (Tables I, II, III) comprised 100 idiopathic epileptics, 105 unclassified mental deficient patients, among which were 2 cretins, and 25 mongols.

Among the 89 cases in the Fountain Hospital (Tables IV, V, VI) 15 were idiopathic epileptics, 61 were unclassified mental deficient patients, one of whom was a patient with congenital syphilis, and 13 were mongols.

Of the 230 cases in Leavesden Hospital, 64 showed dental malformations of various types, 13 were doubtful, and 153 had normal teeth. Of the 89 cases in Fountain Hospital 20 patients exhibited dental lesions, 2 patients had to be regarded as doubtful, and 67 had normal teeth.

The 83 cases who were examined ophthalmologically as well as dentally were grouped according to their psychiatric diagnosis, and then subdivided according to the positive or negative findings in their teeth. In these groups there were :

51 idiopathic epileptics (Tables VIIA, B, C).

19 mongols (Tables VIIIA, B).

13 unclassified mental deficient patients (Tables IXA, B).

Among the 51 idiopathic epileptics (Tables VIIA, B, C, and Table X) the results were :

Teeth :

Positive . . .	27 (53%)
Doubtful . . .	5 (10%)
Negative . . .	19 (37%)

Eyes :

Positive . . .	24 (47%)
(1 due to congenital syphilis).	
Negative . . .	27 (53%)

Among the 19 mongols (Tables VIIIA, B and Table XI) the results were :

Teeth :

Positive . . .	16 (84%)
Doubtful . . .	1 (5%)
Negative . . .	2 (11%)

Eyes :

Positive . . .	14 (74%)
Doubtful . . .	1 (5%)
Negative . . .	4 (21%)

Among the 13 unclassified mental deficient patients (Tables IXA, B and Table XII) the incidence was as follows :

<i>Teeth :</i>				<i>Eyes :</i>			
Positive	.	.	9 (70%)	Positive	.	.	5 (38%)
Doubtful	.	.		Doubtful	.	.	1 (8%)
Negative	.	.	4 (30%)	Negative	.	.	7 (54%)

Sex was not found to influence the dental condition.

The observations show that the highest incidence of dental and lenticular lesions is found in mongols.

The typical dental changes in mongols were the malformation of shape producing the haplodont or peg-shaped tooth, and the smallness of the permanent dentition (microdontia), giving the appearance of deciduous teeth, and frequent discrepancy in size between the various groups of teeth, particularly between the lateral and central incisors (Figs. 1, 2).

The commonest defect, hypoplasia of the enamel, encountered in the idiopathic epileptic and unclassified mental deficient group is characterized by pitting and grooving of the enamel along the developmental lines. This defect persists at different levels in different groups of teeth, due to the fact that the causes for the anomalies take effect at a certain growth period involving, therefore, various tooth groups at different stages of development. (Figs. 3, 4, 5, 6). Hence, the lesions will be found nearer to the incisal edge or occlusal surface, which is the first part of the tooth to form, in some groups, in others they will be farther away. Of the other defects, only on one occasion was microdontia found in idiopathic epileptics and unclassified mental deficient patients. As far as can be ascertained it appeared that the incidence of dental disorders was more marked in those patients whose family history showed other cases of mental deficiency (Figs. 3, 4, 5, 6). It was frequently found, furthermore, that where there were birth injuries, traumata or post-natal disease, those patients did not show any evidence of dental, or lenticular pathological development.

The eye changes observed in the 83 patients examined with the slit lamp and ophthalmoscope were mostly lenticular, as appears from the tables and statistics given above. A few other congenital anomalies of minor import were also found, namely incomplete persistence of hyaloid artery (2 cases), persistent pupillary membrane (2 cases), opaque nerve fibres, inferior crescent, pigment ring round optic disc, gliosis of disc and choroideaemia (one case each). Acquired eye conditions were few, but posterior synechiae (3 cases), traumatic cataract, dislocation of one lens, trachomatous pannus and secondary optic atrophy (one case each) were found.

The changes in the lenses, apart from the 2 cases above, were all of developmental type. They were most frequent in the group of mongols and included the conditions described and depicted by Lowe (1949), namely *arcuate opacities* due to maldevelopment of the lens fibres themselves, and arising between the second and third month of intra-uterine life, *dot-like or flake opacities* outside the foetal nucleus, of coronary type due to various lacunae and vacuoles

between the lens fibres and arising during post-natal life, and *suture cataracts* due to deposition of opaque material in the Y sutures of the foetal nucleus, and therefore ante-natal (third month onwards). The *coronary opacities* are frequently found in normal individuals, but among mongols their incidence



FIG. 1.—H. F—, age 27. Mongol (imbecile). M.A. 4, 6 years, I.Q. 32. Teeth: Malformed and peg-shaped. Eyes: Positive findings. Speech: Defective. Palate: High.



FIG. 2.—D. W—, age 18. Mongol. M.A. 3, 4 years, I.Q. 31. Microdontia. Palate: High. Tongue: Mongolian (fissured). Small last fingers on both hands.

is higher than would have been expected. Even mild cases in the mongols were associated with defective tooth development.

In some of the mongols with coronary opacities there were also brightly-coloured crystalline dots in the cortex of the type usually labelled "endocrine cataract." All this agrees with Lowe's findings, that many different types of

lenticular maldevelopment can be found in mongols, and it is further interesting to note their almost constant association with dental abnormality.

In the other groups (idiopathic epileptic and unclassified mental deficient patient) lens opacities did not occur in so high a proportion, but their associa-



FIG. 3.—H. St—, age 35. Epileptic (imbecile). M.A. 4, 11 years, I.Q. 36. Enamel hypoplasia. Two brothers mentally defective.



FIG. 4.—E. S—, age 46. Epileptic (imbecile). M. A. 5 years, I.Q. 36. Enamel hypoplasia and dwarfing of the teeth. *Eyes: Positive findings.* Hearing: slightly deaf. Patient is left-handed. One sister mentally defective. Three sisters died in infancy.

tion when they occurred with dental anomalies was striking. In the epileptics coronary opacities were commonest but, in addition, Vogt's axial embryonic cataract (arising at the second month of intra-uterine life) and lamellar cataract were also found and were also associated with dental anomalies.

Among the idiots and imbeciles who were not epileptic, coronary, lamellar and axial cataracts also occurred and were again associated with dental

anomalies. Occasionally, disturbances at two levels in the lens (e.g. Vogt's anterior axial and coronary cataract) were found in the same eye in patients with abnormal teeth. It is, however, obvious from the tables that the associated incidence of lenticular and dental anomalies is highest in the mongols and lowest



FIG. 5.—C. McC—, age 28. Unclassified mentally deficient patient (imbecile). M.A. 5, 6 years, I. Q. 40. Teeth: Enamel hypoplasia. Eyes: Positive findings. Heart: Mitral stenosis. One sister and six cousins are mentally defective.

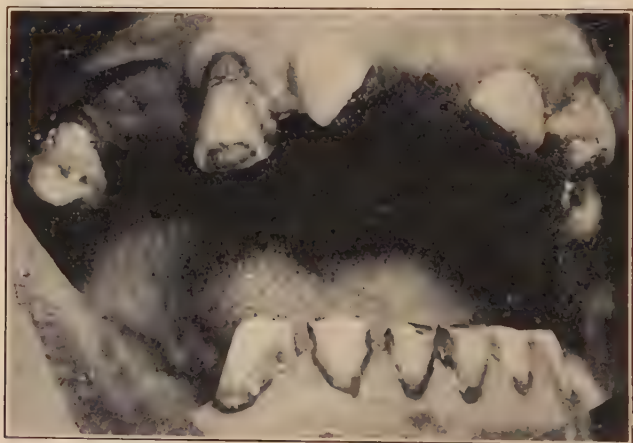


FIG. 6.—J. S—, age 40. Unclassified mental deficient patient (imbecile). M.A. 4, 7 years, I.Q. 33. Teeth: Enamel hypoplasia. Eyes: Positive findings. Two brothers mentally defective.

in the unclassified mental deficient group. This might be expected when one considers the greater structural (skeletal and other mesodermal) anomalies present in mongols than in the other groups.

This association of two ectodermal anomalies (teeth and lens) in individuals with defective cerebral development points to an upset (environmental? genetic?) occurring at an early age. The connection of hypoplastic teeth with

lamellar cataract and the presence of cataract in mongolism has long been known but the present observations extend the principle of lenticulo-dental association in development over a greater range of disorders than was formerly suspected, and afford a possible means of assessing the developmental nature of certain defects, such as epilepsy, which otherwise might have arisen from post-natal environmental causes.

The following tables (I, II, III) show the type of lens opacity and the probable date at which the abnormal lens fibres developed. The fact that in a number of cases with abnormal teeth the opacity did not form until adolescence, does not rule out a genetic cause, since developmental anomalies are not necessarily congenital. In 10 cases evidence of both early ante-natal and adolescent abnormality existed in the same eye. In many cases also, familial defect was apparent; in some the ocular and dental anomaly was accompanied by developmental defect in other organs as well, e.g. deaf-mutism, cardiac lesions, digital anomalies, hemiplegia and cleft palate, all pointing to an early upset of general development. The association of deaf-mutism, cataract and cardiac lesions suggests a disturbance at the second month, but it is interesting that in those cases which showed it the cataract is different in type and not so severe as that found in the rubella syndrome.

DISCUSSION.

The purpose of this survey is to show that various dental and lenticular anomalies are part of a symptom complex, pre-natal in origin.

In addition, an attempt has been made to assess whether these defects are wholly inherited, whether they are acquired foetal lesions, or whether they are due to a summation of both these factors.

The pre-natal origin of the peg-shaped, malformed tooth and of microdontia is undoubted.

Enamel hypoplasia belongs to a different category. It may be due either to pre-natal or post-natal disturbances. Two different types of enamel defects exist, commonly referred to as enamel hypoplasia, although this terminology is not fully satisfactory.

The first is the true hypoplasia of developmental origin, due to an imperfect or aplastic enamel organ resulting from hereditary or early foetal interferences. The other is an enamel lesion caused by disturbance of the calcium metabolism giving rise to hypocalcification effects.

In both, the tooth anomalies are frequently associated with lens defects due to the similarity of origin in both organs (Mann, 1937; Parsons and Stallard, 1942). Such acquired structural enamel defects have been observed in cases of rickets, malnutrition and disturbance of the endocrine function, e.g. parathyroid deficiency (Sarnat and Schour, 1941, 1942; Fish, 1948). However, if post-natal causes are indicted, the diseases have to act over a long period of time and before the termination of the calcification process to produce marked enamel changes. They are usually linked with arrested bone formation.

Recent papers on the aetiology of dental anomalies (Goldman and Bloom, 1949; Boyd, 1943) emphasize that true enamel hypoplasia is primarily linked

TABLE I.—*Leavesden Hospital.—Idiopathic Epileptics, 100 Cases.*

Systemic mental disease.	No. of cases.	Sex.		Mental age.	I.Q.	Tooth changes.					Other associated congenital lesions.			Cases with mental deficiency in family.	
		Male.	Female.			Positive.	Hypo- plasia.	Mal- forma- tions.	Micro- dontia.	Doubt- ful.	Nega- tive.	Retarded develop- ment.	Deaf		Cardiac
Feeble- minded	49	19	30	7	45	13	12	1	1	4	32	14	Deaf, 1	..	Mental deficiency in family, 7. Congenital syphilis, 2. Trauma, 6. Birth premature, 1. Meningitis, 2. Hemiplegia, 3.
Imbeciles	45	20	25	4-6	8	18	17	2	1	2	25	15	Deaf, 3 Deaf & Dumb, 1	..	Mental deficiency in family, 6. Congenital syphilis, 1. Trauma, 3. Birth premature, 2. Meningitis, 2. Hemiplegia, 2. Trauma, 1.
Idiots	6	2	4	1-3	19	2	2	..	..	1	3	3	..	..	
Total	100	..	..	..	..	33	..	..	..	7	60	..	..	..	

Mental deficiency in family, 7.
 Congenital syphilis, 2.
 Trauma, 6.
 Birth premature, 1.
 Meningitis, 2.
 Hemiplegia, 3.
 Mental deficiency in family, 6.
 Congenital syphilis, 1.
 Trauma, 3.
 Birth premature, 2.
 Meningitis, 2.
 Hemiplegia, 2.
 Trauma, 1.

TABLE II.—*Leavesden Hospital.—Unclassified Mentally Deficient Patients. 105 Cases.*

Systemic mental disease.	No. of cases.	Sex.		Mental age. I.Q. From	Tooth changes.					Other associated congenital lesions.			Cases with mental deficiency in family.	
		Male.	Fe- male.		Posi- tive.	Hypo- plasia.	Mal- forma- tions.	Micro- dontia.	Doubt- ful.	Nega- tive.	Retarded develop- ment.	Deaf Mutism.		Cardiac lesions.
Feeble- minded	38	15	23	7 . 45 .	3	3	1	..	..	35	1	..	1	Mental deficiency in family, 5. Meningitis, 3. Trauma, 2.
Imbeciles	57	32	25	Up to .4-6.8 . 44 .	9	9	2	..	3	45	13	Deaf, 1	1	Mental deficiency in family, 5. Birth premature, 3. Hemiplegia, 1. Trauma, 1.
Idiots	8	5	3	Up to 1-3 . 19 .	2	2	..	..	1	5	2	..	..	
Cretin	2	1	1		..	..	..	..	..	2	..	..	..	
Total	105	..	..		14	..	..	..	4	87	..	..	..	

TABLE III.—*Leavesden Hospital.—Mongols, 25 Cases.*

Systemic mental disease.	No. of cases.	Sex.		Mental age.	I.Q.	Tooth changes.					Other associated lesions.			
		Male.	Fe- male.			Posi- tive.	Hypo- plas- ia.	Mal- forma- tions.	Micro- dontia.	Doubt- ful.	Nega- tive.	Retarded. develop- ment.	Deaf Mutism. lesions.	Cases with mental deficiency in family.
Feeble-minded	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Imbeciles	18	4	14	4-6.8	44	13	3	8	5	1	4	16	1	Mental deficiency in family, 4.
Idiots.	7	4	3	1-3	19	4	..	3	1	1	2	5	1	..
Total	25	8	17	..	..	17	..	..	..	2	6	..	..	..

TABLE IV.—*Fountain Hospital.—Idiopathic Epileptics, 15 Cases.*

Systemic mental disease	No. of cases.	Sex.		Mental age.	I.Q. From	Tooth changes.					Other associated congenital lesions.			Notes on patients' history and cases with mental defi- ciency in family.	
		Male.	Fe- male.			Posi- tive.	Hypo- plasia.	Mal- forma- tions.	Micro- dontia.	Doubt- ful.	Retarded develop- ment.	Deaf Mutism.	Cardiac lesions.		
A. Feeble minded	1	..	1	7	45	..	..	..	..	..	..	..	..	..	Mental deficiency in family, 1.
B. Imbeciles	12	..	12	4-6.8	45	3	3	1	..	1	8	2	..	..	Birth premature, 3. Mental deficiency in family, 5.
C. Idiots.	2	..	2	1-3	19	..	..	..	..	..	2	..	..	..	Cannot speak, 1.
Total	15	..	15	..	..	3	..	..	..	1	11	..	..	..	..

TABLE V.—*Fountain Hospital.—Unclassified Mentally Deficient Patients, 61 Cases.*

Systemic mental disease	No. of cases.	Sex.		Mental age. I.Q.	Tooth changes.					Congenital lesions.			Notes on patients' history and cases with mental deficiency in family.	
		Male.	Female.		Positive.	Hypoplasia.	Malformations.	Microdontia.	Doubtful.	Negative.	Retarded development.	Deaf Mutism.		Cardiac lesions.
A. Feeble-minded	14	..	14	7 . 45	2	2	..	..	..	12	2	..	..	Mental deficiency in family, 6.
B. Imbeciles	42	1	41	4-6.8 . 45	5	5	1	..	1	36	Microcephalic, 1	..	..	Mental deficiency in family, 7. Congenital syphilis, 1.
C. Idiots	5	..	5	1-3 . 19	..	..	..	..	..	5	..	..	..	Congenital syphilis, 1.

TABLE VI.—*Fountain Hospital.—Mongols, 13 Cases.*

Systemic mental disease.	No. of cases.	Sex.		Mental age. I.Q.	Tooth changes.					Other associated congenital lesions.			Notes on patients' history and cases with mental deficiency in family.
		Male.	Female.		Positive.	Hypo- plasia.	Mal- forma- tions.	Micro- dontia.	Doubt- ful.	Nega- tive.	Retarded develop- ment.	Deaf Mutism.	
A. Feeble-minded	..	..	..	7 . 45	..	..	..	..	..	..	..	..	..
B. Imbeciles.	12	1	11	.4-6.8 . 45	9	..	8	3	..	3	4	..	..
C. Idiots	1	..	1	1-3 . 19	1	..	1	..	..	..	1	..	..
Total	13	1	12	 10	10	..	..	..	..	3	..	..	..

with either a faulty development in the enamel matrix or imperfect tooth primordia. In addition, Cockayne (1933) and Fish (1948) mention instances of enamel hypoplasia due to a primary ectodermal lesion. The reasons for assuming that the structural enamel lesions reported in this paper are due to pre-natal interference are :

1. The incidence is decidedly greater in the mental defectives than in the normal population.
2. There is a definite correlation in the incidence between these enamel defects and other proved congenital anomalies.
3. The most important associated clinical defects are in the lens. These, which are accepted as developmental, suggest that the same aetiological factors are acting to produce the dental lesions.
4. The lesions in the enamel were more marked than would be likely to occur with post-natal causes.
5. No other stigmata or clinical symptoms were found which could have been ascribed to post-natal influences.
6. The presence of dental lesions with developmental anomalies and mental deficiency is consistent with the pattern of other well-defined congenital diseases. Some of the questions involved will be better understood if the function of the embryonic layer in the formation of the tooth primordia is first briefly considered. The enamel of the tooth is a product of the ectoderm which starts to differentiate into the dental lamina in the 6 to 7 weeks' embryo. This is the time at which the ectodermal lining of the mouth cavity grows down into the mesenchyme and forms the enamel organ. From this enamel organ the deciduous teeth are first produced, but the same organ also produces the permanent teeth, and these are thus part of the primary dental lamina. This primordium already bears the inherent stigmata of hereditary or early environmental influences and determines, to a large degree, shape and structure of both dentitions. It must be remembered in this connection that not only the enamel but also nervous tissue and lens are of the same ectodermal derivation.

In cases where there is an interference with the development three different types of dental disorders may appear :

1. Anodontia.
2. Peg-shaped tooth and microdontia.
3. Enamel hypoplasia. This is a condition where defective enamel prisms will be added to the unimpaired tissue. This defect persists and forms the hypoplastic lesion (Mellanby, M., 1934 ; and Mellanby, H., 1941). Any such lesion of the enamel cannot be repaired at later stages of embryonic or post-natal development. Similarly, lenticular embryonic defects are irreversible (Mann, 1937 ; Bellows, 1944). It has been a subject of controversy whether the clinically apparent dental defects are due to genetic causes or are due to interference by environmental influences acting before birth or shortly after. Any one of these causes may affect the tooth in its developmental state. A lesion of the ectoderm or deficient ameloblasts can constitute a cause for the dental anomalies. Similar changes will appear if the cells are subjected to inflammation during the period of maximum cellular activity. Since the

primordia of the teeth are laid down at different periods of foetal life, the congenital manifestations will vary in degree and location according to cause and time, but such changes will be bilateral and identical, while other groups of teeth may completely be unaffected.

In spite of the importance of both genetic and acquired factors in the aetiology of mental disease, the dental manifestations have been little studied. The dental lesions in the cases reported are clinically allied with mental diseases which are regarded as pre-natal. In a significant number of cases other defects of undoubted congenital origin besides the lens changes are present. The associated complications are cleft palate, hare-lip, webbing of fingers and toes, brachycephaly, epicanthus and deafness. All these cannot be regarded as incidental complications.

The high incidence of associated dental and lenticular anomalies are very suggestive of a common aetiological factor or factors.

The clinical examination is, with all its limitations, one way to approach the problem of whether the tooth defects are due to post-natal environmental influences or whether they are congenital. The findings in this paper provide important evidence of the latter. Among 51 idiopathic epileptics in Leavesden Hospital (Tables VIIA, B, C, and Table X) there were 20 with both dental and lenticular lesions. Among these 51 patients, 9 showed other congenital malformations or lesions. Although the family history was available only in a few cases, 7 patients in this group had records of mental deficiency in the family. Of the 19 mongols (Tables VIIIA, B, and Table XI), 14 cases had both dental and lenticular lesions. Four patients in this category had records of mental deficiency in the family. Seven of these 14 cases exhibited other congenital malformations such as webbed fingers or toes (one case), congenital heart defects (2 cases), and epicanthus and brachycephaly (one case), and 3 others showed minor congenital changes such as high palate or a fissured tongue. Of 5 unclassified mentally deficient patients (Tables IXA, B, and Table XII) with positive findings in teeth and eyes, 2 gave histories of mental deficiency in the family. One (J. S—) had an epileptic brother in the same hospital, another (Th. B—) had an epileptic father and a feeble-minded sister. A third case (Ch. McC—), with dental lesions and a slight anomaly of the retinal disc (inferior crescent), had one mentally defective sister and 6 mentally defective cousins. There were no data on the family history of the other 3 cases. One of these 6 patients (E. M—), with no family history or records on the sibship, was slightly deaf and had a high palate.

Of the 4 cases with negative findings in teeth and eyes, 2 patients had a history of trauma and one had had encephalitic lethargica which was thought to be the possible cause of the mental condition. An analysis of both these positive and negative findings shows that dental disorders are much more prevalent among these mental patients than among the general population. Bruckner (1943), cited by Stones (1948), gives the incidence of hypoplasia in the permanent teeth among the general population at 0.7 per cent. A higher percentage (5 per cent.) has been found in Chicago schoolchildren by Greenwald (quoted by Sarnat and Schour, 1942). The absence of teeth (anodontia) and certain types of tooth anomalies, such as the malformation of shape (haplodont

TABLE VII.—*Leavesden Hospital.—Epileptics (Feeble-minded).*

Congenital defects in patients.											Notes on patients' history and mental def. in family.					
Name.	Age.	Sex.	Ment. age.	I.Q.	Tooth changes.				Eye changes.			Other congenital conditions.				
					Posi- tive.	Hypo- forma- tion.	Mal- occlu- sion.	Micro- dontia.	Doubt- ful.	Nega- tive.		Posi- tive.	Nega- tive.	Doubt- ful.	Deaf- mutism.	Cardiac lesions.
1. F. D—	30	F.	9	..	+	+	—	—	—	—	+	—	—	..	..	Mother and cousin on maternal side ment. def.
2. P. P—	26	F.	7·7	55	+	—	+	—	—	—	—	+	—	..	Cleft palate. Very thin and long fingers and toes.	Birth premature.
3. M. D—	37	F.	10·8	..	—	—	—	—	—	—	+	—	—	..	..	"Stroke," meningitis when 9 months old.
4. A. Y—	19	F.	..	..	—	—	—	—	—	—	+	—	—	..	..	Def. observed at 16 years of age. Pat. knocked down by car when 12 years old.
5. E. A. P—	28	M.	7·3	52	—	—	—	—	—	—	+	—	—	..	..	Def. observed at 7 years of age. Brother died at mental hosp.
6. J. R. W—	29	M.	..	..	—	—	—	—	—	—	+	—	—	..	..	Trauma. Fall when 3 years old. Def. observed when 5 years old.
7. A. E. H—	37	M.	7·5	..	—	—	—	—	—	—	+	—	—	..	..	Def. observed at 4 years of age.
8. F. M—	41	M.	8·6	61	—	—	—	—	—	—	+	—	—	..	..	Trauma. Knocked down by car when 5 years old. Unconscious.
9. T. W. B—	27	M.	10·3	73	—	—	—	—	—	—	+	—	—	..	..	Noted at school age.
10. J. H—	23	F.	..	..	—	—	—	—	—	—	+	—	—	..	Right hemiparesis	
11. W. M—	31	F.	7·3	52	—	—	—	—	—	—	+	—	—	..	Slightly deaf	
12. D. A. G—	33	F.	9·6	66	—	—	—	—	—	—	+	—	—	..	Slightly deaf	Def. observed when 10 years old. Sister ment. def.

TABLE VIIA.—*Leavesden Hospital.—Epileptics (Feeble-minded)—contd.*

Name.	Age.	Sex.	Ment. age.	I.Q.	Congenital defects in patients.										Notes on patients' history and mental def. in family.
					Tooth changes.					Eye changes.					
					Posi- tive.	Hypo- plasia.	Mal- tion.	Micro- dontia.	Doubt- ful.	Nega- tive.	Posi- tive.	Nega- tive.	Doubt- ful.	Other cong. malformations.	
13. M. D. B—	26	F.	7	50	+	+	—	—	—	—	—	+	+	..	Meningitis when 13 months old.
14. J. G. G—	28	F.	9·6	69	—	—	—	—	—	—	—	—	—	..	
15. H. A. F—	42	M.	..	..	+	+	—	—	—	—	—	+	..	Palate high. Internal strabismus	W.R. +. Parallel Tests + + + +.
16. F. A—	47	F.	7·8	..	+	—	—	—	—	—	—	—	..	Hutchinson teeth in maxilla	
17. N. L—	34	F.	10·8	77	—	—	—	—	—	—	—	+	..	..	..
18. W. G. R—	34	M.	8	57	+	—	+	—	—	—	—	—	..	..	
19. C. S—	47	F.	8·5	61	+	—	—	—	—	—	—	+	..	..	Paralysis at the age of 2. Spastic paraplegia (brain injury). Def. noted at age of 13.
20. B. B—	45	F.	6·5	46	+	—	—	—	—	—	—	—	..	..	
21. G. E. W—	44	F.	6·8	49	—	—	—	—	—	—	—	+	Left facial palsy with wasting	..	..
22. H. E. H—	32	F.	10·2	73	—	—	—	—	—	—	—	+	..	..	
23. G. W—	25	F.	7·2	51	—	—	—	—	—	—	—	+	..	..	Trauma: knocked down by car when 5.
24. E. E. W—	27	F.	8·9	62	—	—	—	—	—	—	—	+	..	..	
25. A. D—	25	M.	8	57	—	—	—	—	—	—	—	+	..	..	Father epileptic. Ment. def. on the paternal side.
26. J. R. H—	41	M.	7·1	56	+	—	—	—	—	—	—	+	..	..	
27. G. M—	45	M.	8	57	+	—	—	—	—	—	—	—	..	..	
28. J. A. H—	28	F.	..	..	+	—	—	—	—	—	—	+	..	..	

Tooth changes:

Positive: 11 cases.

Negative: 16 cases.

Doubtful: 1 case.

Total: 28 cases.

Males: 10.

Females: 18

TABLE VII.B.—*Leavesden Hospital.—Epileptics (Imbeciles).*

Name.	Age.	Sex.	Ment. age.	I.Q.	Congenital defects in patients.										Notes on patients' history and mental def. in family.		
					Tooth changes.				Eye changes.		Other congenital conditions.						
					Posi- tive.	Hypo- plasia.	Mal- forma- tion.	Micro- dontia.	Nega- tive.	Posi- tive.	Nega- tive.	Deaf- mutism.	Cardiac lesions.	Other cong. malformations.			
1. C. D—	25	M.	Tests inapplicable.		+	+	—	—	—	+	—	—	+	..	High palate	Mother, 2 brothers, one sister ment. def. One brother and sister deaf and dumb.	
2. A. M—	64	M.	4.7 . 32		+	+	—	—	—	+	—	—	—	..	Defective speech	Father deaf. Paternal Grandfather ment. def.	
3. R. W—	45	F.	5.7 . 40		+	+	—	—	—	+	—	—	..	..	..	Sister ment. def.	
4. E. S—	47	F.	5 . 36		+	+	—	—	—	+	—	—	..	..	Slight deafness	..	
5. F. S—	37	F.	Tests inapplicable		+	+	—	+	—	+	Nil. Develop- mental syphilitic	—	..	..	Right hemiplegia	..	
6. E. A. P—	43	F.	5.6 . 40		+	+	—	—	—	+	—	..	..	Mitral stenosis	Left hemiplegia	..	
7. J. G. B—	37	M.			—	—	—	+	—	+	—	..	..	..	..	History of insanity on the maternal side.	
8. E. J. H—	45	F.	4.3 . 32		+	+	—	—	—	+	—	..	..	..	Deaf	..	
9. B. S—	44	F.	5 . 37		+	+	—	—	—	+	—	..	..	..	Palate high. Little fingers abducted from midline	..	
10. H. R. H—	28	M.	5.9 . 41		—	—	—	—	+	—	+	..	..	..	Palate high	..	
11. T. W. C—	40	M.			+	+	—	—	—	+	—	..	..	..	Left hemiplegia	Trauma (accident when one year old).	
12. H. S—	35	M.	4.11. 36		+	+	—	—	—	—	+	..	..	..	Palate high	One brother ment. def.	
13. N. S—	43	F.	3.5 . 25		+	+	—	—	—	—	+	..	..	..	Adherent lobes	Meanacke + + +.	
14. P. M. W—	28	F.	Tests inapplicable		—	—	—	—	+	—	+	..	..	..	..	..	Trauma and meningitis when 5 months old.
15. W. S—	43	F.	5.1 . 37		—	—	—	—	+	—	+	..	..	..	Left hemiplegia	Mother suffered motor accident in third month of pregnancy.	
16. R. B—	26	F.	3.8 . 27		+	+	—	—	—	+	—	..	..	..	Left hemiplegia	Birth premature (6 months).	
17. R. M. D—	25	F.	5 . 36		—	—	—	+	—	—	—	..	..	..	Right hemiplegia	Grandfather ment. def.	
18. J. B—	47	M.	4.4 . 31		+	+	—	—	—	+	—	..	..	..	..	..	..
19. C. W. L—	35	M.	5.6 . 39		+	+	—	—	—	—	—	..	..	..	..	..	Mother had a fall during pregnancy. Birth diffi- cult and prolonged.
20. A. M. F—	46	F.	6 . . .		—	—	—	—	+	—	+	..	..	..	Slight epicanthus	Def. noted at school age. Mother ment. def.	

TABLE VIIc.—*Leavesden Hospital.—Epileptics (Idiots).*

Name.	Age.	Sex.	I.Q.	Ment. age.	Congenital defects in patients.						Notes on patients' history and mental def. in family.				
					Tooth changes.			Eye changes.				Other congenital conditions.			
					Posi- tive.	Hypo- plasia.	Mal- form- tion.	Micro- dontia.	Doubt- ful.	Nega- tive.			Deaf mutism.	Cardiac lesions.	Other cong. malformations.
1. J. R—	41	M.	18	2.5	—	—	—	—	—	—	—	—	—	—	—
2. M. K—	46	M.	20	2.9	+	+	—	—	—	—	—	—	—	—	—
3. I. G—	31	F.	19	2.7	+	+	—	—	—	—	—	—	—	—	—
															Deficiency was observed from infancy.

TABLE VIIIa.—*Leavesden Hospital.—Mongols (Imbeciles).*

Congenital defects in patients.											
Name.	Age.	Sex.	Ment. age.	I.Q.	Tooth changes.			Eye changes.		Other congenital conditions.	Notes on patients' history and mental def. in family.
					Posi- tive.	Hypo- plasia.	Mal- form- tion.	Micro- dontia.	Doubt- ful.		
1. H. F—	27	M.	32	4.6	+	—	+	—	+	..	One miscarriage, other sibs normal.
2. G. L. H—	33	F.	37	5.2	+	—	—	—	—	..	Pat. is the fourth child
3. C. C—	24	F.	27	3.8	+	—	—	—	—	..	Three others normal.
4. F. H—	41	F.	33	4.7	+	—	—	—	—	..	Cousin imbecile. Mother, defective speech.
5. M. L. P—	27	F.	38	5.3	+	—	—	—	—	..	..
6. F. R—	31	F.	27	3.8	+	+	—	—	—	..	Premature birth.
7. P. N. S—	21	F.	39	5.5	+	—	—	—	—	..	Sister imbecile (dead); Aunt had epilepsy. Pat. last of 9 pregnancies.
8. I. H—	27	F.	..	..	+	—	—	—	—	..	Defective is the second child of a family of 3; the other 2 are normal.
9. H. R—	27	F.	32	4.5	+	—	—	—	—	..	Maternal .. grandfather died in mental hospital.
10. A. E. T—	37	M.	..	..	+	+	—	—	—	..	Pat. is the first in a family of 2. Father's brother was a mental defective. Father died in diabetic coma. Pat. suffered from <i>petit mal</i> in childhood.
11. J. H. D—	32	M.	3.8	26	+	—	+	—	—	..	..
12. D. K—	40	F.	..	..	+	—	—	—	—	..	..
13. L. E. K—	25	M.	3.6	25	—	—	—	+	—	..	..
14. F. M. S—	43	F.	2.8	20	—	—	—	—	—	..	..
15. E. M. C—	28	F.	3.8	26	+	—	—	—	—	+	..

TABLE VIII.B.—*Leavesden Hospital.—Mongols (Idiots).*

Name.	Age.	Sex.	Ment. age.	I.Q.	Congenital defects in patients.						Notes on patients' history and mental def. in family.		
					Tooth changes.		Eye changes.		Other congenital conditions.				
					Mal-formation.	Micro-dontia.	Doubtful.	Negative.	Positive.	Negative.		Deaf mutism.	Cardiac lesions.
I. G. G. S—	35	M.	17	2.2	+	—	—	—	+	—	—	Palate high.	..
2. A. G—	23	F.	..	..	+	—	—	—	+	—	—	Tongue mongolian	..
3 F. M—	43	M.	18	2.6	+	—	—	—	+	—	+	Webbed fingers on left hand, webbed toes on both feet. Skin not very much pigmented	..
4. B. L. G—	26	F.	..	..	—	—	+	—	—	+	—	..	Birth premature.

TABLE IX.A.—*Leavesden Hospital.—Unclassified Mental Deficient Patients (Feeble-minded).*

Name.	Age.	Sex.	Ment. age.	I.Q.	Congenital defects in patients.							Notes on patients' history and mental def. in family.	
					Tooth changes.		Eye changes.		Other congenital conditions.				
					Posi- tive,	Hypo-forma- tive, plasia.	Mal- tion, donia.	Micro- ful.	Nega- tive,	Posi- tive,	Nega- tive,		Deaf mutism.
1. F. O—	41	M.	11.8	84	—	—	—	—	+	—	—	—	Encephalitis lethargica when 12 years old; up to that date bright and normal.
2. E. H—	40	M.	10.2	72	—	—	—	—	—	+	—	—	Trauma in history.
3. D. R. J—	24	F.	6.5	46	+	—	—	—	—	—	—	—	Mother had fall during pregnancy. One brother feeble-minded.
4. T. B—	28	M.	7.1	..	+	—	—	—	—	+	—	—	Age of talking: 4 years. Father epileptic. Sister feeble-minded.

TABLE IXB.—*Leavesden Hospital.—Unclassified Mental Deficient Patients (Imbeciles).*

Name.	Age.	Sex.	Ment. age.	I.Q.	Congenital defects in patients.										Notes on patients' history and mental def. in family.
					Tooth changes.					Eye changes.					
					Posi. Hypo-plasia.	Mal-formation.	Micro-Dontia.	Doubt-ful.	Nega-tive.	Posi. Nega-tive.	Doubt-ful.	Deaf mutism.	Cardiac lesions.	Other cong. malformations.	
1. J. S—	41	M.	4·7	33	+	—	+	—	—	—	+	—	—	—	One brother feeble-minded and epileptic, another brother ment. def.
2. E. M—	41	M.	5·2	37	+	+	—	—	—	—	+	—	—	—	..
3. F. B—	47	M.	4·3	31	+	—	—	—	—	—	—	—	—	—	Mother feeble-minded, father feeble-minded(?) Twin, other child died at 6 months.
4. B. M. D—	26	F.	5·6	40	—	—	—	—	—	+	—	—	—	—	Parturition : instruments. Mother had a fall at third month of pregnancy. Maternal cousin : imbecile.
5. G. M. M—	40	F.	5·7	41	—	—	—	—	—	+	—	—	—	—	Sister and 6 cousins.
6. C. S. M—	28	M.	5·6	40	+	—	—	—	—	—	—	—	—	—	..
7. H. B—	45	M.	5·1	37	+	—	—	—	—	—	—	—	—	—	..
8. W. A—	32	M.	very low.	Idiot	+	—	—	—	—	—	+	—	—	—	Endocrine : sexually immature. No pubic or axill. hair.
9. T. S—	35	M.	Under one year.	Idiot	+	—	—	—	—	—	—	+	—	—	Birth premature.

TABLE X.—*Leavesden Hospital.*—*Table of Associated Incidence of Dental and Lenticular Malformations.*
Idiopathic Epileptics : 51 Cases.

		Eyes.			
		Positive.	Doubtful.	Negative.	Total.
Teeth	Positive	20	..	7	27
	Doubtful	2	..	3	5
	Negative	2	..	17	19
	Total	24	..	27	51

TABLE XI.—*Leavesden Hospital.*—*Table of Associated Incidence of Dental and Lenticular Malformations.*

Mongols : 19 Cases.

		Eyes.			
		Positive.	Doubtful.	Negative.	Total.
Teeth	Positive	14	1	1	16
	Doubtful	..	..	1	1
	Negative	..	..	2	2
	Total	14	1	4	19

TABLE XII.—*Leavesden Hospital.*—*Table of Associated Incidence of Dental and Lenticular Malformations.*

Unclassified Mental Deficient Patients : 13 Cases.

		Eyes.			
		Positive.	Doubtful.	Negative.	Total.
Teeth	Positive	5	1	3	9
	Doubtful	..	..	..	..
	Negative	..	..	4	4
	Total	5	1	7	13

tooth), found in mongols, are most unusual and rarely encountered in normal people. These lesions are essentially the result of early dental maldevelopment, which agrees with Penrose's view (1934), that mongolism is a condition of abnormal or arrested development.

Peg-shaped or haplodont teeth are examples of primitive teeth in non-human dentitions from which the crowns of the normal teeth in men have gradually been formed (Keith, 1948). They are an indication of an arrest of growth during the transitional stage of development. Anodontia is a manifestation of an even more severe developmental interference with the ectodermal layer (Thomas, 1939).

Consideration of these cases suggests an aetiological relationship for the dental and other congenital disorders and the mental disease.

When one considers congenital syphilis and maternal rubella, and their effects on the tooth structures, it is clear that congenital lesions need not necessarily be genetically determined. In these conditions the cause of the abnormalities is clearly due to pre-natal environmental factors. On the other hand, in hereditary congenital lesions the genetical causes are the only deter-

TABLE XIII.—*Epileptics. 51 Examined. 23 with Eye Changes.*

Name.	Nature of lenticular defect.	Probable time.	Remarks.	Nature of dental lesion.
C. D.—	Diffuse opacity in posterior cortex and sutures of adult nucleus	From birth onwards	Small, persistent hyaloid artery, also patient is deaf mute with "Gothic" palate. Teeth ab-	Hypoplastic lesions in grooves.
A. M.—	R.: opaque dislocated lens. L.: Vogt's ant. axial cataract.	Post-natal trauma. month ante-natal.	Teeth abnormal	Hypoplastic lesions in shallow pits and grooves.
R. W.—	Dot-like opacities in posterior cortex	Early post-natal	Abnormally very slight. Teeth abnormal	Hypoplastic lesions.
F. D.—	Arcuate opacities and Vogt's axial cataract	Second month ante-natal and at birth	Teeth abnormal	Hypoplastic lesions in pitted grooves.
E. S.—	Lamellar cataract	Third month ante-natal to third month post-natal	ditto	Hypoplastic lesions at the incisal parts, some teeth dwarfed.
F. S.—	Secondary cataract from syphilitic iritis	..	"	Hypoplastic lesions in pits, malformed teeth, microdontia.
E. P.—	Dot-like opacities in cortex	Post-natal, early	"	Hypoplastic lesions.
J. B.—	Single layer of dotted cataract	At birth	Teeth normal	..
T. W. B.—	Coronary cataract	Adolescence	ditto	..
M. D.—	Coronary and blue dot cataract	"	"	..
J. H.—	Punctate opacities in posterior cortex	Birth	Teeth abnormal	Hypoplastic lesions near the cervical parts.

TABLE XIII.B.—*Epileptics*. 51 Examined. 23 with Eye Changes.

Name.	Nature of lenticular defect	Probable time.	Remarks.	Nature of dental lesion.
M. B—	Very few posterior punctate opacities	Birth	Teeth abnormal	Hypoplastic lesions, very thin layer of enamel at other parts.
H. A. F—	Punctate cortical opacities	Just post-natal	ditto	Hypoplastic lesions in horizontal grooves.
M. K—	Opacities on surface of adult nucleus	Late adolescence	"	Dense hypoplastic lesions of the enamel.
I. G—	Vogt's axial cataract	Second month ante-natal	"	Hypoplastic lesions in pits and grooves.
E. J. H—	Coronary cataract	Adolescence	"	Hypoplastic lesions of the enamel, not very marked.
B. S—	Lamellar cataract in two separate zones	Sixth month ante-natal and adolescence	"	Enamel hypoplasia, not very marked. High palate.
R. B—	Arcuate type of cataract in a single layer	Eighth month ante-natal	Teeth hypoplastic	Enamel hypoplasia in grooves near the incisal edges.
R. D—	Secondary cataract	Post-natal	Teeth inconclusive. Eye condition is secondary to iritis	"
J. B—	Vogt's axial cataract	Second month ante-natal	Also shows congenital anomaly of optic disc. Teeth inconclusive	Thin hypoplastic lesions of the enamel.
C. L—	Dot-like opacities in foetal nucleus	Third to eighth month ante-natal	Teeth slightly abnormal	Enamel hypoplasia in grooves near the incisal edges.
J. R. H—	Punctate opacity in posterior foetal nucleus	End of foetal life	Teeth abnormal	Small hypoplastic grooves and microdontia.
G. M—	Small lamellar cataract	Second to sixth month ante-natal	ditto	Enamel hypoplasia in horizontal grooves.

TABLE XIV.—*Feeble-minded and Imbeciles. 13 Examined. 5 with Eye Changes.*

Name.	Nature of lenticular defect.	Probable time.	Remarks.	Nature of dental lesion.
J. S—	Flake opacities	Between 8 months ante-natal and 6 months post-natal	Teeth abnormal	Densely pitted hypoplastic grooves. Teeth slightly dwarfed.
T. B—	Dust-like opacities in foetal nucleus and blue dot and coronary	Before fifth month and during adolescence	ditto	Marked hypoplastic horizontal grooves.
E. M—	Coronary cataract and Vogt's axial cataract	Second month ante-natal and during adolescence	"	Marked hypoplastic defects.
H. B—	Lamellar cataract	Three months ante-natal	"	Hypoplasia in grooves and pits.
W. A—	Coronary type. Very slight	Adolescence	"	Hypoplasia.

TABLE XV.—*Mongols. 19 Examined. 14 with Eye Changes.*

Name.	Nature of lenticular defect.	Probable time.	Remarks.	Nature of dental lesion.
G. S—	Subcapsular	Late adolescence	Teeth abnormal	Malformed peg-shaped teeth, with dented incisal edges.
H. F—	Coronary cataract	Adolescence	ditto	Malformed peg-shaped teeth, with serrated incisal edges.
G. L. H—	ditto	"	"	Hypoplastic lesions and partial microdontia.
C. C—	Cortical opacities slight	Late adolescence	"	Severe microdontia.
F. H—	Coronary and arcuate opacity, severe	Last months of foetal life and during adolescence	"	Microdontia.
M. L. P—	Suture and dot cataract	Fifth month ante-natal and during adolescence	" (microdontia)	Severe microdontia.
D. K—	Coronary cataract, severe	Adolescence	Teeth abnormal (microdontia)	ditto
A. G—	Coronary and suture cataract	Fifth month ante-natal and adolescence	Teeth grossly abnormal	Grossly malformed peg-shaped teeth.
J. H—	Severe coronary cataract	Adolescence	Teeth abnormal	Microdontia, defective enamel.
H. R—	Subcapsular opacities	Late adolescence	ditto	Severe microdontia.
A. E. T—	Coronary opacities	Adolescence	"	Hypoplastic defects, peg-shaped canines.
F. R—	Severe coronary cataract	"	"	Malformed peg-shaped teeth, with defective enamel.
F. McC—	Slight coronary cataract	Late adolescence	"	Hypoplastic lesions in pits.
E. M. C—	Suture and dot cataract	Fifth month ante-natal and during adolescence	"	Peg-shaped malformed teeth, with jagged incisal edges.

minant of the disease. A good example is the hereditary ectodermal dysplasia of the anhidrotic type. The condition is generally regarded as due to a recessively inherited gene, and involvement of the teeth is an example of a dental anomaly of such origin. The argument that teeth are under genetic control is supported by Burks (1938), Snyder (1941), and Gates (1946), who discuss various dental disorders of genetic aetiology.

Benda emphasizes that malformations of the central nervous system are usually associated with other stigmata of arrested development. The evidence from the data presented establishes a linkage between the causes of the endogenous mental deficiency and associated developmental lesions. There is unanimity of opinion as to the hereditary character of feeble-mindedness. Regarding idiopathic epilepsy, the constitutional factors in the causation of this disorder are generally considered to be of great importance. Lennox (1947) concludes that predisposition to epilepsy, rather than epilepsy itself, is inherited, and that probably in most patients genetic and acquired factors are instrumental in producing the epileptic condition.

Mongolism comes into a third category, in which the disease is only partly determined by heredity (Penrose, 1934; Halperin, 1946). Other causes, such as the age of the mother and congenital endocrine dysfunction, are mentioned (Benda, 1947). Recently, Ingalls and Gordon (1947) have suggested that uterine bleeding in the early months of gestation may constitute an environmental condition leading to mongolism.

It is well known that mongols exhibit the largest variety of malformations among the mental defectives. Organs of all three derivatives are affected.

As regards the dentition, the skeletal deformities such as the high, arched palate, the cleft palate and the small jaws with the resulting malocclusion can be ascribed to disturbances in the mesodermal layer.

The other, more severe structural disorders of the dental tissue itself, the peg-shaped form, the microdontia and the anodontia are likely to be predominantly conditioned by the same causes which produce the physical characteristics of the skin, lens and hair. They are all indicative of a defective ectodermal layer, or of an impairment to its normal growth.

It is of interest to note that the front, or oral, part of the tongue is the seat of the typical changes in mongols. This part is covered with a mucosa of ectodermal origin. The inference from these observations is that the dental lesions are aetiologically allied with the other anomalies.

There are transitional forms of dental malformations to be found in these cases, from the near-normal to the grossly abnormal. The teeth in the mongols present the most pronounced dental defects in all three groups.

In mongols the nature and pathology of the systemic condition account for a dental manifestation (microdontia, peg-shaped teeth, anodontia and hypoplasia), which seems to be induced by developmental interference. The idiopathic epileptics and imbeciles show milder types of anomalies. The dental lesions seen in idiopathic epileptics and imbeciles are mostly hypoplasia of the enamel, which, however, in itself, is no less a significant sign of defective development.

The stage of development of the afflicted organ makes it more vulnerable

at one period of gestation than at the other. This fact provides a possible explanation for the presence or absence of anomalies, whose production may be attained or suppressed in one stage or the other. Experimental investigations have shown (von Bahr, 1936; Mellanby, 1941) that the onset of environmental causes can only take effect before the differentiation and calcification of the tooth organ is terminated. The combination and interrelation of these factors explain the occurrence, types and degrees of the dental lesions.

A conclusive answer to the various questions involved will necessitate a study of the histological and radiological appearance of teeth and jaws, as well as the clinical examination, since the microscopic examination may disclose even those congenital anomalies which are subclinical but, nevertheless, significant for the pathology. In addition, the other ectodermal derivatives have to be included in such an investigation, since variable conditions occur in skin, hair and nails. They may also reveal manifestations of an inhibited or arrested development (Cockayne, 1933).

To test the theory of a genetic tendency, it may be of importance to study the electroencephalogram in cases with both dental and lenticular lesions. It is conceivable that epileptics and mentally deficient patients with such lesions may have electroencephalographic patterns differing in some way from the tracings obtained in cases without such associated disorders (Lennox and Gibbs, 1944; Lennox, 1947). It is hoped to submit a series of patients for such an investigation later on.

Furthermore, the examination of the near relatives is essential, in order to see whether an hereditary trait can be found in this pathology (Penrose, 1934; Benda, 1946; Halperin, 1946). The extension of the present investigation in these two directions would be an aid in the evaluation and interpretation of the underlying causes of the dental anomalies we have been considering.

SUMMARY.

An investigation has been made on the occurrence of various disorders of the teeth and the lens in mental defectives. In order to ascertain the incidence of developmental malformations, 319 mental cases were examined clinically. Of these, 83 underwent slit-lamp examination of the lenses.

The structural pattern of the teeth was affected in 84 cases. The incidence of dental disorders in these patients is thus significantly higher than among the normal population.

The dental anomalies are most prevalent in mongols and the association with lenticular defects is also most pronounced in this group.

Idiopathic epileptics and the unclassified mental deficient patients show dental changes in some way different from those encountered in the mongols, but also often co-existing with lens defects.

The mental and lenticular disorders are pre-natal in origin.

The data provide evidence for the fact that the anomalies of the dentition are aetiologically related with the other congenital defects.

It is acknowledged that a defection in the layer or an interference with its normal development will induce concomitant changes in various organs of the same derivation.

Hence, the involvement of the teeth in this process in association with other congenital lesions tends to confirm the argument that the dental changes are part of a syndrome of a systemic condition.

It is considered that the aetiological factors for these disorders are in the ectoderm, and that its inherent characteristics and its mode of development play an important part in the pathogenesis.

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FUNCTION AND TRAINING OF THE CLINICAL PSYCHOLOGIST.*

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(1) INTRODUCTION.

- (1) Introduction.
- (2) Growth and history of clinical psychology.
- (3) Status and training of the clinical psychologist.
 - (a) Undergraduate training.
 - (b) Duration of post-graduate training.
 - (c) Diagnostic testing.
 - (d) Research.
 - (e) Therapy.
 - (f) Grades of clinical psychologist.
 - (g) Integration of academic and clinical work.
- (4) Psychiatry and clinical psychology.
- (5) Summary and conclusions.

THE past ten years have seen a spectacular increase in the number of psychologists who have elected to take up the type of work usually referred to as "clinical." This increase has been most marked in the U.S.A., where now some 25 per cent. of the members of the American Psychological Association are employed in this field, and where Government regulations and training schemes set up under the V.A. (Veterans' Administration) make it almost certain that within a few years clinical psychology will constitute the main field of employment for psychologists (1). In Canada, too, there has been a similar growth, leading to all the problems of registration and certification which are currently being tackled in the United States (2). In this country, while psychologists have occasionally been employed in hospitals for the

* This article owes much to the opportunities which the writer has had during a six months' visiting professorship at the University of Pennsylvania of investigating the growth and development of clinical psychology in the United States. Thanks are due to the authorities of the university, particularly Professor R. A. Brotemarkle, for their kindness in permitting the writer to travel widely during term time. The writer thus had an opportunity of inspecting mental hospitals, V.A. clinics and university departments engaged in the training of clinical psychologists in places as widely different as San Francisco and St. Louis, Los Angeles and Durham, Chicago and Philadelphia, New York and Washington. Thanks are also due to the many individuals, whether connected with the V.A. programme or in some other way concerned with the training of clinical psychologists, who discussed their problems, plans, and views with the writer, and who answered patiently many queries and objections which must have betrayed a good deal of ignorance, as well as a certain amount of prejudice. However critical one may be of certain details in current practice, it is impossible not to be impressed by the sincerity of those who are trying to transform clinical psychology into a genuine profession, and with the considerable success which has attended their efforts so far. If the writer is still convinced that the pattern of training currently followed at the Institute of Psychiatry (Maudsley Hospital), has certain advantages over the American system, this belief is now predicated on a much better realization of the very real differences which exist between the two countries with respect to many variables which affect the aims and purposes of such a training course.

mentally ill, the development of "clinical psychology" in any formal sense may be said to have started in 1947 with the foundation of the Psychological Department at the Institute of Psychiatry (Maudsley Hospital), one of whose objects was to give a course of training in clinical psychology to graduate students of psychology (7).

In view of the novelty in this country of the discipline as a whole, it is scarcely surprising that no very clear conception regarding the functions it subserves exists among psychiatrists and psychologists, or that the type of training required is not widely recognized or understood. It is the purpose of this article to discuss these problems, and to give a brief picture of the functions and the training of the clinical psychologist. In doing so, our intention has not been to slur over differences of opinion which inevitably exist in so new a field, and our conclusions should be regarded as tentative and provisional, not as dogmatic assertions.

No formal definition could indicate with any accuracy the variety of different functions which clinical psychologists fulfil or should fulfil. They serve in hospitals and children's clinics; in prisons, courts, and on parole boards; in psychoanalytic institutes and non-directive "counselling" units; in Government agencies and in the armed forces; in Universities and in mental defective institutions. More informative, however, than their place of work will be a description of the duties which they perform, and for which they are trained. These duties, in turn, having grown organically from seeds planted long ago, can best be understood in terms of a brief historical review.

(2) GROWTH AND HISTORY OF CLINICAL PSYCHOLOGY.

In 1896 Lightner Witmer established the first psychological clinic at the University of Pennsylvania, an event frequently taken to have marked the point of origin of the whole movement. In 1917 the first professional organization for the study of clinical problems was founded (18). In 1931 a symposium on Clinical Psychology was published by the University of Pennsylvania, which showed how widely this term had become accepted, and to what extent agreement had been reached with respect to the field covered (20).

Such success as clinical psychology had had did not, however, lead universities to undertake professional training in the application of psychology to the problems of the individual. While single courses on mental testing, psychopathology, industrial psychology or social psychology were given to students who elected to work in this area, little was done to develop a type of training which could in any sense be regarded as "professional." This fact, together with the lack of agreement on the duties and responsibilities of a clinical psychologist, led to a situation of great difficulty and danger. A person who called himself a "clinical psychologist" might be someone of great eminence, highly qualified academically, and with 20 or 30 years of practical experience in the fields of diagnostic testing, research, and therapy, or he might be a student just graduated from the University, without any kind of relevant experience, capable only of grinding out Binet I.Qs. without even an adequate understanding of their relevance to the clinical problem presented (6). This was

the position in America until about 1940; with only minor ameliorating features, it is still the position in this country to-day.

Miller has painted an accurate picture of the situation: "Before the war the profession of clinical psychology had little organized self-consciousness, despite the existence of various associations established to further the interest of the field. One of the chief reasons for this was the fact that it was almost impossible to find anywhere a well-rounded and complete program of education for the practice of clinical psychology. Either training was in the basic experimental and academic tradition of American university psychology, in which research and teaching were permanent considerations and the application of the principles learned was only incidental; or training was obtained almost wholly in the hospital, sanitarium, guidance clinic, prison, or social agency under the supervision of psychiatrists and others not trained or skilled in psychology proper. All too commonly training was an individually determined hodge-podge of poorly integrated university sources, clinical internships, private study of special techniques, and unsupervised practice. There was no agreement throughout the country on how curricula should weave together all the divergent strands into a properly designed education for clinical psychologists" (16).

During the past few years a transformation has occurred which to many people has seemed miraculous. While many factors have contributed towards this transformation, a catalyst was needed; it was provided by social need arising out of the war. Examination of the draft revealed that over 30 per cent. of the young men conscripted suffered from disabling neuropsychiatric defects (19); examination in England of a working-class group showed a very similar percentage (10). More than three-fifths of all patients in Veterans' Hospitals in 1946 were neuropsychiatric cases, all other types of cases combined amounting only to two-fifths (16). "Necessity of war mobilized the resources of clinical psychology in a way comparable to the mobilization of the resources of physics and chemistry. . . . It became recognized that the diagnostic skill of psychologists and their superior understanding of the principles of normal behaviour and how these can be applied to problems of personal adjustment were invaluable adjuncts to the medical profession. The result was that psychologists in the Army, Navy, and other military organizations were given tasks of great responsibility and professional importance" (16).

This importance did not diminish after the end of the war. Through the Veterans' Administration the American nation assumes a measure of responsibility for looking after its war casualties; as pointed out above, the majority of these casualties at present are neuropsychiatric. "With the rising morbidity rate of mental disease, demand for psychiatrists and psychologists will increase. This demand will occur because of the necessity of implementing the social responsibility which has been assumed for treating the largest part of mental disease of veterans—a segment of the population which now represents about one-seventh of all America. The significant and inevitable consequence of this development is that a large portion of the whole profession of clinical psychology will come under Governmental control" (16).

Within the V.A. programme five sorts of installations are being (or have

been) set up : Mental Hygiene Clinics ; Neuropsychiatric Convalescent Centres in general medical and surgical hospitals ; Neuropsychiatric hospitals ; Paraplegia Centres in general hospitals ; and Aphasic Centres in general hospitals. These various units are described by Miller in some detail ; in all of them the clinical psychologist will have important diagnostic, therapeutic and research functions. " Diagnosis of personality characteristics will remain the primary task of the psychologist, for his training makes him better qualified than the psychiatrist in this field " (16). Even more important perhaps is the research function of the clinical psychologists, "trained as they are in test construction, experimental design, and scientific method, and the independent conducting of research, will make their most significant contribution to the program in the field of research " (16).

More controversial perhaps than either of these two is the therapeutic function of the clinical psychologist. Our own position on this point will be stated later ; here we may just note the official V.A. statement on this point : " The clinical psychologist will carry out individual or group therapy under direction of the responsible neuropsychiatrist. This means that the neuropsychiatrist will first review the case and decide whether it is the type of problem which may reasonably be handled by a clinical psychologist. If the case involves such fields as readjustment of habits ; personality problems within the normal range ; educational disabilities such as reading defects, speech impairments, or similar difficulties requiring re-education ; or relatively minor psychoneurotic conditions without important somatic components, the patient may be referred to a clinical psychologist for individual or group treatment. The Chief neuropsychiatrist will delegate such therapeutic duties only when he believes the individual clinical psychologist to be fully competent to carry them out. The clinical psychologist periodically at staff meetings or other times will report to the responsible neuropsychiatrist on the progress of the therapy and consult with him as to further measures to be taken."

In addition to outlining the functions of the clinical psychologist, the V.A. has gone further in laying down minimum standards for the various grades of clinical psychologists ; in starting a large-scale training scheme with the co-operation of most of the better universities ; and in taking a large measure of responsibility in the financing of the training of large numbers of clinical psychologists. In all these activities the influence of the V.A. has been almost wholly beneficial, and by working in close co-operation with the American Psychological Association as well as with the universities, the V.A. programme has been successful to a very considerable extent.

Before turning from this brief historical review to a discussion of the present-day position, we must say a few words about the British scene. Here conditions are very different, largely because of historical developments which have forced a rather divergent pattern of growth on applied psychology. With very few exceptions, clinical psychologists in this country have worked almost exclusively with children ; all training in the field of applied psychology (other than industrial) has been in what became known as " educational psychology," although the relation of such activities as play therapy or child guidance work to education is not always clear. The result has been a three-

fold one. In the first instance, applied training in this field has been given almost exclusively to psychologists who have had teaching experience of at least two years. The theory underlying this practice appears to be that the educational psychologist would thus be able to acquire "maturity," to learn about "normal" children, and to become more acceptable to teachers during his later career, when presumably he would have to come into frequent contact with them.

A consequence of this insistence on "educational" psychology has been that therapeutic activities have been growing up *sub rosa*, as it were, and without adequate training or supervision. Many educational psychologists working in child guidance clinics are actually engaged in full-time therapeutic work, although their title prevents the recognition of the absolute necessity of training in the therapeutic field if they are to practise in it.

In the third place, the close relation between psychology and education thus fostered has led, on the other hand, to a rather less close relation between psychology and psychiatry, and medicine generally. Particularly in the important adult field contacts between the two professions have been correct rather than cordial, and there can be little doubt that this lack of recognition of the inseparable destinies of the two disciplines has been detrimental to the advance of both. That a strong, respected and highly competent profession of psychiatry is essential to the growth and flourishing of clinical psychology appears obvious; it is perhaps no less true to say that the existence of a large group of well-trained, competent, and friendly clinical psychologists can be of the utmost value to psychiatry.

In order to facilitate such a rapprochement, a course of training in Clinical Psychology was started at the Institute of Psychiatry (Maudsley Hospital) two years ago. At the same time, negotiations which are being carried on with the appropriate Whitley Council by the A.Sc.W. should have resulted in agreement on salary scales, as well as an acceptable definition of "clinical psychologist," and the various grades into which this profession should be divided. Thus more slowly, and less spectacularly, than in America, here also a new profession, with defined status and training, is coming into being.

(3) STATUS AND TRAINING OF CLINICAL PSYCHOLOGISTS.

Function, status and training of any professional group are clearly closely interrelated. Discussion of the present position in the field of clinical psychology can perhaps most usefully begin with a consideration of three documents regarding the training of clinical psychologists. The first of these, "Recommended Graduate Training Program in Clinical Psychology," is an official report submitted by the Committee on Training in Clinical Psychology of the American Psychological Association (5); it will be referred to as the A.P.A. report. The second document is a report of the transactions of the first conference on Training in Clinical Psychology, sponsored by the Josiah Macy Jr. Foundation (13); it will be referred to as the Conference report. The third is a discussion of the proposals contained in these two reports, comparing them with present-day English practice (7); this will be referred to as the Maudsley report.

All three reports agree that professional training should be post-graduate, that it should occupy a period of several years, that it should lead to a high level of competence in diagnostic testing, and that ability in research design, and knowledge of the relevant statistical and methodological techniques, should be a prerequisite for the fully trained clinical psychologist. There is disagreement on the question of therapy, on separate courses for different grades of psychologist, and on the best method of integration of teaching hospital and university.

(a) *Undergraduate training*.—Professional training in clinical psychology should not begin until after the student has acquired a certain amount of grounding in general and experimental psychology, together with a limited knowledge at least of statistics, mental test methods, and abnormal psychology generally. This strictly theoretical background the student may be expected to acquire during his Honours course of studies for the B.A. or the B.Sc. degree in Psychology. While an Honours degree in psychology is thus considered an indispensable preliminary for further training in this country, it should be realized that in itself it does not suffice to give the student any competence in the applied field. Its orientation is rather theoretical, and lacks integration with clinical, industrial, or educational applications. This exclusively academic-theoretical approach does not make for practical usefulness of the student when released from the university; for acquiring any kind of practical training he has hitherto had to rely largely on non-University bodies and Institutions prepared to give tuition of very varying quality, or on his own ingenuity in picking up whatever knowledge he needed. While the Honours degree in psychology is thus a necessary prerequisite for further training, it does not in itself denote any degree of psychological competence in the applied field. This cannot be stressed too strongly, as many psychiatrists assume that possession of a degree in psychology qualifies the student as a psychologist, just as possession of a medical degree qualifies the student as a physician. Medical training is a professional training; psychological training is not professional, but purely academic. This is stated, not as a criticism, but merely as a fact; whether the present-day practice of undergraduate instruction is sound or not cannot be discussed here.

(b) *Duration of post-graduate training*.—The V.A. training programme envisages a four-year period of instruction and clinical practice, somewhat along the following lines. Each trainee is expected to spend 1,056 hours a year (22 hours per week times 48 weeks) at work in V.A. hospitals. The rest of his time will be devoted to training under the direction of the Department of Psychology at his University, carried on either at the V.A. station, at the University, or elsewhere. The universities are responsible for planning curricula, and for deciding how much training should be carried out at the University, and how much at the V.A. station. Trainees are paid at varying rates, depending on the amount of time given to the V.A., and on the stage of training reached.

During the first year the student administers simple psychometric tests, mainly of intelligence. He also interprets these findings in the light of details of the case-history, and makes factual reports on these results to supervising

psychologists and psychiatrists. During the second year he administers a wide range of techniques, including intelligence tests, personality inventories, attitude tests, vocational and other types of aptitude tests, projective techniques, group situations (psychodrama and others), and interprets the significance of the findings as they are related to the entire case-history. During the third year, in addition to the above, he makes recommendations as to the treatment or disposition of the case to supervising psychologists; interviews patients in the hospital or clinic, and other persons who have relationships to the patients, for purposes of diagnosis, counselling and guidance on matters of mental health and related subjects; he also does therapy under the direction of a psychiatrist. During the fourth year he adds to these duties that of carrying on psychological research and investigation on questions of mental health; instructs other interns in psychological principles, their application, and in simple psychological techniques. At the end of this year he would be expected to obtain his Ph.D. degree from his university on the basis of a thesis relating to his work.

Additional experience brings the trainee into progressively higher salary groups. After he has reached the highest stage, his remuneration depends on factors which cannot be put down simply in terms of agreed salary schedules; by analogy with the comparable civil service positions (21) the highest salary he may aspire to in normal non-commercial positions will be between £4,000 and £5,000. (In arriving at English equivalents for American salaries, we have divided by 3; having regard to differences in cost of living, in income tax, and other factors difficult to assess, American salaries would probably come out at an even higher figure.)

Compared with this four-year programme, the training scheme of the Institute of Psychiatry shows certain differences which will be explained when we have discussed the main points on which we differ from the American practice in respect of desirability of teaching therapy; perhaps the most potent factor, however, making the two programmes impossible to equate in any thorough-going fashion, relates to the fact that trainees in America are paid in large measure by the V.A., while students in this country usually have to bear their own costs. This fact thwarts any attempt to install a programme here which could rival the American in comprehensiveness; only if the State undertook in some form to be responsible for training and maintenance (perhaps through some form of internship scheme) could we hope to train clinical psychologists in comparative numbers to a similar standard of excellence. We do not differ, however, in our insistence that several years of professional training are essential before the clinical psychologist can be considered fully trained.

(c) *Diagnostic testing*.—To many readers the use of tests in the clinical situation is perhaps the most obvious task of the clinical psychologist; frequently the term "test" is understood in the severely restricted sense of "intelligence test," and the psychologist regarded as a psycho-technician whose sole duty is the grinding out of I.Qs. While such a misconception must appear grotesque to anyone familiar with the wide range of cognitive and temperament tests which the properly trained psychologist is able to administer and interpret, it nevertheless has some roots in the former practice of training educational psychologists in the use of the Binet to the exclusion of almost

any other test ; this has set up a firm vested interest of " Binet testers," of specialists in a rather outmoded, unrevealing, and only seemingly " accurate " scale of measurement which has been outdated by modern developments for at least two decades. Perhaps the worst consequence of this traditional hegemony has been the widespread belief that the I.Q. is the Alpha and Omega of psychology. Nothing could be further from the truth. While a suitably derived I.Q. is still the most diagnostic single figure by means of which a patient's cognitive ability can be characterized, there is much opposition to the idea that any one single figure should ever have to bear such a burden. It is usually far more important clinically to know that a patient has a high verbal ability, low visuo-spatial ability, very low manipulative ability, but comparatively good rote-memory and excellent associative fluency, than to be told that his I.Q. is around the 100 mark. The concept of the mental profile, rather than the mental index number, is to the fore in modern clinical testing.

In arriving at a mental profile, of course, the clinical psychologist must have a thorough background training in the experimental and statistical methods which have enabled us to isolate and measure the various constituent abilities which make up the general field of cognition. He must be familiar with the different testing devices which are at his disposal ; he must know their respective strengths and weaknesses, as well as their relevance and applicability to certain types of patient, of background, and of clinical problem. And he must be able to interpret the results in terms of the whole clinical picture, possibly by integrating seemingly divergent results from different series of tests. The actual giving of a test is usually the least skilled part of the whole procedure, and can often be handed over to a technician ; it is in the selection of suitable tests, and in their interpretation, that the skilled clinical psychologist shows his metal.

This is equally true, and perhaps even more obvious, when we turn to non-cognitive tests, either of the so-called projective, the objective, or the questionnaire-inventory type. There are enthusiasts who could elevate one of these categories, or even one test within one of these categories, such as the Rorschach, into the be-all and end-all of psychological testing, thus repeating in another field the error of the Binet-testers. There are others who would deny the slightest value to tests in one of these categories—questionnaires, for instance. The well-trained clinical psychologist should be familiar with the strong as well as with the weak points of tests of all kinds, and equally competent to recommend, give, and interpret the Thematic Apperception Test, the Level of Aspiration Test, and the Minnesota Multiphasic Personality Inventory. The multiplicity of tests with which the clinical psychologist should be familiar is perhaps best indicated in the writer's review of advances in this field during the past five years, which ran into a selected bibliography of over six hundred titles (8).

Also included under this general heading of diagnostics are certain types of investigations which are not always considered in this connection. For instance, the objective determination of the course and success of treatment would be included here, as would also be vocational guidance and other questions

arising in the disposal of the patient, in so far as the answer to these questions was aided by the use of diagnostic tests of validity, personality, attitudes, interests, knowledge, and so forth.

(d) *Research*.—There is unanimity among almost all those competent to judge that it is in the sphere of research that the psychologist has his most important contribution to make. He has had a formal training in the techniques of research; he is acquainted with the statistical methods necessary for establishing significance; without such training little can be achieved in the complex and difficult field of human personality. It is his skill in research methodology, more than any other ability or proficiency, which makes the psychologist a useful member of the psychiatric team.

What precisely does the term "research" denote in this context? It has two different meanings, differing in importance and appealing to rather different types of psychologists. In the first place, we have what may be called technical or *ad hoc* research. By this is meant work on the reliability of tests and their intercorrelations, on agreement of tests with ratings, diagnoses, and so forth, and on the standardization or restandardization of new and old tests. Work of this kind is done within the framework of existing theory and practice, and while it requires a high degree of technical competence, it contributes relatively little to the systematic science of psychology. It is extremely unfortunate, though perhaps inevitable, that most of the research done under the aegis of the V.A. is of this routine, technical, uninspired kind. The mistake of believing that what is essentially actuarial work can do much to build up a systematic science is one to which psychiatrists have often drawn attention, and we cannot but agree with their point of view, without, however, denying the practical usefulness of much of this type of research.

Much more important from the strictly scientific point of view is fundamental research, which aims to uncover the structure of personality, its dynamics, and the general laws of behaviour and learning. It is here that close integration of psychiatric experience and theory, and psychological testing and research design, can prove most useful, because it is precisely here that the ultimate key to the puzzles which cause our joint difficulties lies hidden. A patient unveiling of the main dimensions of personality, the experimental study of the joint influence of heredity and environment, and the investigation of the results of different types of therapy on different types of patients—solutions to these and other fundamental problems have been adumbrated in researches published from many centres during the past ten years, and some of this work bids fair to revitalize and revolutionize a psychiatry partly straight-jacketed in Kräpelinian classifications, and partly enjoying manic spells of Freudian theorizing.

All types of research investigation demand, first and foremost, competence in statistical treatment of data, and in research methodology. The clinical psychologist should be familiar with factor analysis, analysis of variance and co-variance, and with other techniques which he is likely to encounter in his reading, and which he may have to apply in his research, whether technical or fundamental. Competence of this kind does not, of course, guarantee the scientific importance of the results; statistics is not an adequate substitute

for insight. It is, however, its indispensable helpmate, and no ingenuity in thinking out hypotheses and deducing consequences will outweigh fundamental weaknesses in methodology and treatment of data. It is the rare combination of worth-while hypothesis and technically competent investigation which must be aimed at, and under present conditions of training it is the clinical psychologist who is most likely to contribute the latter to the psychiatric team just as the psychiatrist so frequently contributes the former, though occasionally the roles may be reversed or inseparably conjoined.

(e) *Therapy*.—This topic is somewhat explosive, as strong views are held on all sides. Many psychiatrists consider that any form of non-medical therapy should be frowned on and discouraged, while others hold that it is impossible even to test a patient without in some important way contributing to his therapy. Clearly, many of the difficulties in this field are merely semantic, and centre around the definition of "therapy." If we understand by the term a prolonged, systematic attempt by means of psychological treatment to produce a fundamental reorientation of the patient's outlook and behaviour, then the writer is opposed to the proposal endorsed by the V.A. training programme, as well as by the A.P.A. and the Conference reports. It is his belief, which finds expression in the training programme at the Maudsley, that such therapy should not form part of the training of the clinical psychologist. The six main reasons for this belief are quoted below from the Maudsley report :

"In the first place it is our belief that in the field of mental illness, no less than in other fields of human endeavour, specialization of function is an inevitable condition for advance. The team of psychiatrist, psychologist and social worker constitutes such a combined attack on a problem, based on specialization of functions. In this team the psychiatrist is responsible for carrying out therapy, the psychologist for diagnostic help and research design, and the social worker for investigation of social conditions in so far as they affect the case. Nothing but confusion and lowered efficiency all round would follow from an attempt to muddle up these different functions to any significant extent. There are far too few persons competent in their own sphere—be that psychiatry, psychology or social work—to allow any but the most exceptional to combine several functions. Training courses are run for the average practitioner, not for the rare and isolated genius. It follows that training in clinical psychology should concentrate on those areas in which the psychologist can make his most significant contribution to the psychiatric team.

In the second place, it seems to us that there are quite unanswerable reasons why therapy must be the prerogative of the physician. In this connection we may quote Dr. D. G. Wright, who points out that "the psychiatrist's part in defining the kind of pathological processes at work must be decisive. A great many pathological processes have significance only to the physician, and are in the first place illnesses which, although manifested by emotional and mental symptoms, are caused directly by injuries, diseases, and other organic processes in the brain. It is the physician's knowledge of the course of the several neurological diseases, and his knowledge of the special investigative procedures . . . which make him competent to determine the localization of and treatment for such a disease. Second, there are several diseases of the organism

as a whole, or of other organs, the symptoms of which may reflect themselves largely in thinking, feeling and behaviour. Hypothyroidism and hyperinsulinism are in this category, and the existence and definition of these is palpably only the physician's job. Third, it is surprisingly common for a serious and progressive organic disease to co-exist with a neurosis of any sort, in which case neurotic-appearing manifestations may mask the other disease until, perhaps, irreversible changes have taken place. . . . It is fair to say that a majority of psychoneurotic patients suffer from somatic reflections of their illnesses of one kind or another and by means of one mechanism or another" (22). Dr. Wright develops this point in greater detail in his article, but what has already been quoted seems to us decisive in determining the respective roles of psychiatrist and psychologist.

In the third place we believe that there are many dangers in the acceptance of the therapeutic role which can best be realized by quoting the following sentence from the A.P.A. report: "Psychologists, in our opinion, must come around to the acceptance of some kind of intensive self-evaluation as an essential part of the training of the clinical psychologist. We are not prepared to recommend any special form of such procedure, although some of us believe that whenever possible this should take the form of psychoanalysis . . . " (5).

The reader may more easily see the danger in this recommendation (which itself is an almost inevitable consequence of the premise that clinical psychologists should do therapy) if he glances at the following statement, made by one of the best-known psychoanalysts in this country, whose experience in the field is probably unrivalled: "The transferences and counter-transferences developing during training analysis tend to give rise in the candidate to an emotional conviction of the soundness of the training analyst's theories" (11). In other words, it is proposed that the young and relatively defenceless student be imbued with the "premature crystallizations of spurious orthodoxy" which constitute Freudianism through the "transferences and counter-transferences" developing during his training. Here, indeed, we have a fine soil on which to plant the seeds of objective, methodologically sound, impartial, and scientifically acceptable research! It is because of this implication—no therapy without analysis—more than for almost any other reason that we wish to protest against the inclusion of therapy in the training syllabus of the clinical psychologist.

Our fourth reason for believing that therapy should not form part of the training of the clinical psychologist is closely related to our first belief that a thorough training in research and diagnostic testing is, in itself, a full-time occupation, and that the addition of a third type of training would merely result in a lower level of skill and knowledge in all three levels. In our experience it takes two academic years to train students in diagnostic testing. It takes at least another two years to teach them the fundamental principles of research and statistical method. If part of this time were given over to learning how to fill the therapeutic role, it is difficult to avoid the conclusion that the training in diagnostic testing and in research would be much less complete than it should be. We need only point to the current research

reports on psychiatric problems and those affecting clinical psychology to show that the level of research competence is distressingly low ; anything mitigating against an improvement in this unsatisfactory state of affairs should at least be considered very carefully.

In the fifth place it has been our experience that students who are interested in the therapeutic side are nearly always repelled by the scientific flavour of research training, while conversely, the students who are best suited and most successful on the research side betray little interest in active therapy. We feel that the A.P.A. Committee dismiss rather too airily this widespread belief that " the scientific and therapeutic attitudes mix poorly in the same person." If our experience be borne out by experimental work, which it should be easy to arrange, we suggest that here is a powerful reason for restricting training in clinical psychology to diagnosis and research.

In the sixth place, we believe that stress on the therapeutic function of the clinical psychologist encourages unscientific thinking in the field of selection. " The ability to carry out effectively the combination of functions called for depends upon the clinical psychologist's being the right kind of person " (5). It is interesting to note the qualities which " the right kind of person " must possess, according to the writers of the A.P.A. report. He must apparently possess, *inter alia*, superior intellectual ability and judgment, originality, resourcefulness and versatility, curiosity, insight, sense of humour, tolerance, " unarrogance," industry, acceptance of responsibility, tact, co-operativeness, integrity, self-control, stability and a variety of qualities whose operational definition would be even more difficult, such as " ability to adopt a ' therapeutic ' attitude." It would be interesting to know the reliability and validity with which any of these " qualities " or " faculties " can be measured or assessed, and to what extent they would characterize the clinical psychologist as opposed to, say, the lawyer, the doctor, the teacher, or any other professional person " (7).

It will be noted that this general opposition to the inclusion of " therapy " in the list of duties of the clinical psychologist only holds as far as is implied in our definition of therapy. There are certain borderline areas which are clearly the psychologist's prerogative, although in some ways they might also be classified as " therapy." Included here are the treatment of educational disabilities, such as reading defects, speech impairments, and other difficulties of a segmental kind requiring re-education. If activities of this type are to be called " therapy," then it seems clear that psychologists should be trained to do therapy ; if the term " therapy " is to be restricted in the manner suggested in this paper, then it seems reasonable to suggest that therapy should remain the prerogative of the physician.

(f) *Different grades of clinical psychologist.* —In principle we believe that the division of labour which we have advocated above in suggesting that research and diagnostic testing should be separated from therapy ought to be carried even further. We find ourselves in full agreement with Dr. A. Gregg, who writes : " I doubt whether the proficiency in research at present called for by the degree of Ph.D. is the best training for as large numbers of psychotechnologists as will meet the rapidly mounting demand for such services. I simply doubt whether research ability of an order appropriate for the Ph.D. degree

exists on so large a scale. If it does not and you insist on all students having the research training appropriate for teachers and investigators, many students participating in well-orientated and well-controlled research work at the Ph.D. level might profit from it in some measure, but the demand is for very large numbers of persons with general practical experience and reasonable competence. Not much more than ten per cent. of medical students are capable at any time of excellent research work. Yet medical research flourishes" (12).

Accordingly, we believe that clinical psychologists should be trained, as it were, in two stages. Stage 1 would give them an adequate theoretical and practical knowledge of psychometric techniques and "psychotechnology" generally; it would enable them to fill the very large number of jobs opening up for persons capable of fulfilling routine, every-day needs of the community. This training, in our view, could be carried out in one rather crowded year (eleven months plus one month's holiday, as is practised at the Maudsley at present), or, alternatively, in two ordinary academic years. This training would come after adequate undergraduate instruction resulting in a Bachelor's Degree in psychology. Competence acquired in this way should be recognized, not by a degree, but by a university Diploma or a Certificate, granted after a searching examination involving practical as well as theoretical work. A person trained in this way would conveniently be called a clinical psychologist, junior grade.

Stage 2 would be additional to stage 1, for a small number of students capable of benefiting from it, and would consist in research training resulting in a Ph.D. Students having undergone this second stage of training could conveniently be considered as clinical psychologists, senior grade. Research work in this connection should be carried out in relation to problems relevant to clinical psychology, but preferably of a fundamental rather than of an applied nature.

In this connection, we place considerable stress on "programme design." We agree with Marquis (15) that "programme design" is of the utmost importance in the future development of psychological research in general, and of clinical research in particular. Programme design, in his view, "is the attempt to plan a comprehensive, integrated series of studies in relation to a particular set of concepts focused on a central problem. It is the attempt to broaden and lengthen the scope of a research sufficiently so that we can tell whether it is really getting anywhere. It is scientific method in its full and complete form." We would suggest, therefore, that the research training of the future clinical psychologist should preferably be carried out as part of a general research programme relevant to his specialty. In our limited experience, such a procedure has the double value of making the student feel that he is really assisting in the construction of something worth while, rather than merely fulfilling an arbitrary, university requirement, while at the same time ensuring that fundamentally important research is done, rather than *ad hoc* work of little scientific value. Ultimately, if Marquis is right in his view that "programme design" will assume greater and greater importance in the advancement of our scientific knowledge of human nature (and we have very little doubt that essentially this submission is correct), then it will be of very great importance that the next

generation of research workers should be trained by actually participating in a research programme of the kind mentioned. This argument is particularly strong in relation to clinical psychology, where almost any worth-while research implies co-operation between specialists of many different backgrounds. We have tried to set a pattern of "programme design" in the series of researches reported in *Dimensions of Personality* (9), and knowledge gained in the process has been used in setting up the next stage of design growing out of our first series of findings.

(g) *Integration of academic and clinical work.*—We believe that the American practice of centring the student's academic teaching on a University Department and of sending him out to a hospital for practical work is not the most efficient and useful way of training him. In our experience, students are more likely to get a unified training in all aspects of clinical psychology when this is given by a University Department itself centred on and located in a Teaching Hospital for Mental Disorders. The advantages for the student of being trained in clinical psychology in a University Department specially devoted to the task of research and training in clinical psychology, as well as to the carrying out of the routine duties of the hospital on which it is centred, are obvious from the point of view of centralization of functions, of specialization, and of participation in "programme design."

(4) PSYCHIATRY AND CLINICAL PSYCHOLOGY.

It will be clear from what has been said that the writer believes that the emergence of a large, well-qualified group of clinical psychologists will be of considerable usefulness to the psychiatrist. Conversely, the more able, well-trained and competent psychiatrists of the future are, the more will the clinical psychologist be able to benefit from association with them. The old and always untenable view which regarded psychiatrists and psychologists in some sense as rivals, and which posited a certain amount of antipathy and dislike between them, is surely ready to be thrown on the scrap heap. The general public fails utterly to distinguish between the two disciplines, and it may truly be said that they sink or swim together. An increase in status and prestige for one will almost inevitably mean an increase in status and prestige for the other; the more effectively psychiatrists and psychologists learn to work together, the greater that prestige, and the higher that status, are likely to be.

However, it is essential in such a relationship to see not only the strong points of each other, but also to recognize the weak. Cattell has pointed out, in commenting on the disparity between what is and what should be, that clinical psychology is "a field of unequalled intellectual challenge; yet it has actually recruited, in addition to its truly competent personnel, a multitude of camp followers of an amateurish status, unaware of the main issues, and large enough in numbers to drown the voices of those who are. It may be asked, at least in these days of shortage of plumbers, if clinical psychometry has not robbed the community of some who might have learned competently to assemble a faucet or understand a domestic water system. Certainly one may doubt whether in the history of applied science there has ever been an era in which so many have known so little about so much" (4). Psychiatrists can help

us in separating the sheep from the goats by insisting on the highest possible qualifications, and the best possible training, in clinical psychologists employed with or under them.

On the other hand there has been a rather different danger. As Burt has pointed out, "the general public, which is far more familiar with 'doctors' than with 'physiologists,' and with 'medical psychologists' than with 'normal psychologists,' is apt to confuse physiology and pathology, psychology and psychiatry, the investigation of a normal personality and the treatment of an abnormal personality that has resulted from actual illness, and generally to confound the practical applications of science with the theoretical research work on which those applications must rest. As a result there has been a widespread tendency to assume that the doctor must himself be a kind of scientist, and that because he is 'medically qualified' he must be not only officially exempt from any taint of charlatanism, but also a scientific expert on every kind of human ill. Magistrates and government departments often seem to share this feeling about the scientific prestige attaching to the medical practitioner as such" (3).

As Burt points out further, "this general attitude has spread far beyond the field of child guidance. By using popular metaphors about educational maladjustment as a 'form of mental illness' and industrial maladjustment as a 'symptom of social ill health,' quite a number of 'medical psychologists' have claimed, not merely that they are the proper experts in the field of educational and industrial psychology, but also that they are the right people to investigate the fitness of applicants for the universities, of entrants to the Civil Service, and of candidates for commissioned rank in the Army and other services" (3).

Burt's solution to the problem raised is that "instead of trying to sweep all human and social problems into its net, the profession of medicine should, now as in the past, seek more and more to hand over its outlying fields to specialists appropriately trained. But, of course, increasing specialization will call for increasing co-ordination, increased differentiation for increased integration. The paramount need is for specialist teams" (3).

(5) SUMMARY AND CONCLUSIONS.

This paper has described the present position of clinical psychology—firmly established and flourishing in the United States, just emerging and in need of careful nurturance in this country. A number of problems relating to the function and the training of clinical psychologists have been discussed, and the following main conclusions arrived at:

(1) It appears desirable from many points of view, not least among which must be counted the future progress and present efficacy of psychiatry, that a strong and competent profession of clinical psychologists be called into existence, to co-operate with psychiatrists and social workers in teams devoted to the investigation and therapy of different types of mental disorder in adults and children.

(2) A lengthy and well-balanced post-graduate training appears essential in order to guarantee such professional competence as is required to make clinical

psychologists as acceptable in their own field as medical practitioners are in theirs; such post-graduate professional training should concentrate on diagnostic testing and research design, but should not include therapy in the sense of "a prolonged systematic attempt by means of psychological treatment to produce a fundamental reorientation of the patient's outlook and behaviour."

(3) Because of their complementary functions and because of the inability of the general public to differentiate between them, psychiatrists and psychologists have everything to gain, and nothing to lose, by the closest possible integration of knowledge, experience and working methods; the closer this integration, the more likely is the ultimate emergence of that unified body of knowledge which alone will be worthy of being called a science of psychology, and of that agreed body of principles of pathology, prognosis and treatment which alone will be worthy of being called the applied science of psychiatry.

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ABILITIES OF MALE MENTAL HOSPITAL PATIENTS.

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INTRODUCTION.

BEFORE the the last war psychological tests were not much used in mental hospitals, as there were few tests suitable for adults and, for that matter, hardly any trained clinical psychologists in the country. The "Binet" test or some modification of it was most commonly used, but it is unsatisfactory for adults, and now redundant. The war produced a considerable number of reliable adult tests, standardized on large samples of service men and women, and, although the effective age-range was restricted by service requirements, the tests are a great improvement on pre-war material, and a welcome addition to the clinical psychologist's stock-in-trade.

During the war, too, mental testing of large numbers of mild psychiatric cases was carried out at the neurosis centres—where there was a close association with the Services selection departments—but comparatively little was done on psychotic casualties in the way of psychometry. This was left for post-war development.

THE PRESENT INVESTIGATION.

In this investigation the group method of testing was tried out on the male population of a large mental hospital in the Midlands. This was done for several reasons ; firstly, because so little has yet been done in this field, secondly to find out if the method is feasible in a mental hospital ; thirdly, to compare the patients' efforts with those of normal people ; and, finally, to see if hospitalization causes deterioration of intellectual abilities as it tends to do with emotions and habits. Most patients who have spent some years in a mental hospital have either not responded to treatment, or were admitted at a time when little treatment was being done, and have become chronic cases.

TESTS USED.

The following test battery was used throughout. For all four of the tests thoroughly reliable adult norms exist.

- | | | | |
|---|---|---|-------------|
| 1. Progressive Matrices Test | . | . | 20 minutes. |
| 2. Shipley Vocabulary Test | . | . | 10 " |
| 3. S.P.3. Arithmetic Test | . | . | 13 " |
| 4. Bennett Mechanical Comprehension Test—British Navy version | . | . | 15 " |

The total testing time was thus about an hour, divided into two sessions—Tests 1 and 2 together—and Tests 3 and 4 together. The testing was done by the psychologist assisted by trained male nurses. Before being tested each patient was interviewed individually, and particulars were taken of his education, job history, etc. Seventy patients were unable to give satisfactory details about themselves, which is not too disappointing. Most of these were from the ward of chronic, old, and deteriorated cases.

With the exception of the infirmary ward of about 28 patients, most of whom were old, feeble, and bedridden, the whole of the male side was dealt with, 537 patients in all.

SOCIO-ECONOMIC DETAILS OF THE GROUP.

The average *age* of the patients was 46.9 years (S.D. 14.1), the youngest being 19, and the oldest 102.

The *hospitalization* varied from a few days to more than 45 years, the average duration being 11.3 years (S.D. 10.3). Neither the oldest patient nor the oldest inhabitant was able to do the tests.

As the hospital is in the heart of an industrial area, and serves a predominantly working-class population, most of the patients were of this type. A fairly reliable job history was obtained from over 400 patients, and their main jobs were classified as follows :

TABLE I.—*Job Classification.*

	%
Professional and executive workers	1.8
Skilled non-manual workers	1.8
Skilled manual workers	13.4
Semi-skilled non-manual workers	4.3
Semi-skilled manual workers	46.2
Unskilled, chiefly manual workers	32.5
	100.0

The types of schooling more or less conform to the above, as the following table shows :

TABLE II.—*Types of Schooling.*

	%
University and college	0.7
Private schools	1.5
Secondary and technical schools	6.0
Elementary schools	89.9
Special and approved schools, orphanages	1.9
	100.0

To round off the details, I mention here the employment position of the patients in the hospital. Of course, this depends upon whether or not there is enough work to go round, or enough staff to supervise it. Bearing these factors in mind, we find, again, a large mass of unskilled labour. At the time of testing 37 per cent. of the patients did virtually no work in the hospital, while another 36 per cent. performed routine ward and kitchen duties, demanding little skill; 14 per cent. or more were working out of doors in the gardens etc.; about 4 per cent. were engaged on outwork sent in by a local firm (this figure had been higher, and the work had been particularly suitable for disturbed patients). The remainder were engaged in handicrafts, or in one of the many maintenance departments of the hospital, such as the laundry, bakery, shoe shop, etc.

TEST FAILURES.

As one would expect, not every patient was able to do the tests, nor was everyone willing to try, despite the persuasive efforts of the testers, some of whom were well known to the patients. Some patients completed one or two of the tests, then refused to continue.

The potential number of tests was 2,148, i.e. four for each of the 537 patients, and the following shows the fate of this potential.

TABLE III.—*Test Successes and Failures.*

	Matrix.	Vocab.	Arith.	Mechan.	Total.	%
Tests done . . .	308	294	270	274	1,146	53.3
Tests not attempted because of :						
Mental state . .	139	148	160	156	603	28.0
Illiteracy . . .	20	21	21	21	83	3.9
Poor sight . . .	10	13	14	14	51	2.4
Deafness . . .	6	6	6	6	24	1.1
(Transfers) . .	—	—	3	3	6	0.3
Refusals	54	55	63	63	235	11.0
	537	537	537	537	2,148	100.0

The patients compare very unfavourably with a normal population—and, indeed, with any population—since nearly half of the test potential is lost for one reason or another. Various reasons, familiar enough to those working in the field, prevented their participation, the patients being preoccupied, withdrawn, hallucinated, deluded, simple, childish, and so on. The average age of the “ Unable ” group (28 per cent.) is 46.9 (S.D. 13.9), i.e. almost identical with the figure for the whole group. Age alone, therefore, does not account for the inability to do the tests. All ages from 20 to 80 were represented in the group. On the other hand, this group had been in hospital for a significantly

longer time than had the whole group, i.e. an average of 14.9 years, as against 11.3 years. Among those who had been in hospital for 0 to 5 years, the percentage unfit for testing was only 8 per cent., while for those who had been in for 25 to 30 years, the percentage rose to 52 per cent. Age and hospitalization must, of course, bear some relation to each other, and in this "Unable" group of patients the correlation is +.5, about the same as for the total group. However, this does not alter the above findings, i.e. that the length of stay in hospital has a more deteriorating effect than age, as judged by test failures.

The 21 illiterates managed to do one single Matrices Test between them, i.e. one test out of a possible 84. This group were, as one would expect, older than the rest, with an average of 55.

Those patients who failed because of poor sight or deafness were also older than the main group, their average ages being 57.5 and 60 respectively.

The percentage of refusals is high, but this is not, perhaps, surprising, in view of the incidence of suspicion, negativism and aggression among the patients. This group, again, is older, i.e. average age 53 years. The percentage of refusals mounts steadily through the age groups, and there is no doubt that the older men are more set in their attitudes to what appears to them to be a kind of examination. Strangely enough, the average time spent in hospital by this group is no higher than that of the total patient population, so that here we have a tendency which is just the opposite of that found in the "Mentally Unable" group, i.e. it is increasing age which brings a higher rate of refusal rather than length of hospitalization.

TEST RESULTS.

Turning now to the actual test results: the table below gives the score distributions—by grades—on the four tests, set against the normal expectation, i.e. army norms. The piling up of scores in the lower grades is at once obvious. Thus, even the 53 per cent. of patients who *could* do the tests came off badly in comparison with a normal population.

TABLE IV.—*Test Results by Grades.*

Grade.	Expected (norms). %	Matrix.	Vocab.	Arith.	Mechan.	Total.
I	10	1	9	4	1	4
II	20	2	8	6	1	5
III +	20	4	9	15	6	8
III —	20	6	10	17	6	10
IV	20	24	20	20	31	24
V	10	63	44	38	55	49

From the combined results of the four tests it appears that nearly half of the patients fall into Grade V, many of them towards the bottom of the grade. Since the numbers of known oligophrenics in the hospital is small,

these poor scores are evidently due largely to psychotic interference. If we add together the low and unreliable scores, the test failures and refusals there is a total wastage of about 60 per cent., or, in other words, about 40 per cent. of reliable records. It is not unlikely that the patients would fall below a normal sample in their original intelligence, but not as far as the above figures show.

DIFFERENTIAL TEST RESULTS.

A glance at the above table shows that mental disturbance has a differential result upon the test scores. On the total patient group the four tests divide themselves neatly—by results—into two sub-groups, the comparatively “Easy” test, i.e. Vocabulary and Arithmetic, and the “Difficult” two, Matrices and Mechanical Comprehension. The two tests in each group approximate closely to each other on total results.

In a normal population the upper and lower halves of the score distribution are exactly equal, and, so to speak, cancel each other out. If we allot a base-line value of zero to the normal curve we have a rough measure of the mental patients’ efforts by comparison. In the patients’ score distributions the lower halves exceed the upper by the following percentages: Matrices, 86 per cent.; Vocabulary, 48 per cent.; Arithmetic, 50 per cent.; and Mechanical, 84 per cent. With test failures and unreliable scores added the last-named test takes bottom place, though there is little to choose between it and the Matrices Test.

Both the “Easy” tests are concerned with habits normally acquired early in life, the Vocabulary Test calling for knowledge of the meaning of words, and the Arithmetic Test for the application of the four fundamental operations of adding, subtracting, multiplying and dividing. (There is a second part to this test which involves knowledge of mensuration and the solution of mathematical problems, but few of our patients made much headway with this section, the bulk of the scores relating to Part I, the “automatic” part.)

The “Difficult” tests both require the ability to reason. In the one case (Matrices) the problems are in the form of diagrams, and in the other (Mechanical Comprehension), in pictorial form with written questions about the pictures. Thus, the mental patients, well below normal in all four tests, are sadly lacking in the ability to reason, as compared with mental functions of a more routine and well-established sort. They can put two and two together literally, but not metaphorically. Even those patients with Grade I scores on the “Easy” tests are brought low on the other two, their average scores on these being three grades less, which is considerable. Among all the patients tested there are only 56 who have achieved a higher score on the “Difficult” tests.

THE EFFECT OF AGE ON TEST SCORES.

In normal people there is evidence to show (1) that up to the age of 40 there is little decline in test scores with increasing age. Among 578 army recruits the highest correlation with age (or the greatest decline with age) was

in the Matrices Test, with an r of $-.340$. Reasoning, sensory, and physical qualities (agility) showed more decline than did the verbal-educational tests, all of which were less than $r \text{ } -.2$. Similarly with mental patients: here the correlations are less, Matrices ($-.22$) being the only test with a correlation exceeding $-.1$. This evidently means that the efforts of younger, as well as older, patients are comparatively poorer than those of normal people, especially in the Mechanical Test. From these results the inference is that mental derangement, present at all ages, seems to have a more deleterious effect than age has upon the tested abilities.

THE EFFECT OF INTELLIGENCE UPON AGE-DECLINE.

In a survey reported by Vernon (2), on 90,000 naval recruits, using the Matrices Test as a measure of "g," it was found that the decline in scores with age varied with the test level. At higher levels the decline seemed to be more gradual and did not effectively show itself until the late 20's. While admitting a possible alternative explanation, Vernon states that "It certainly looks as if the most intelligent retain their intelligence longest." In his table the tendency is fairly clear-cut, but not so in the case of the patients: partly, no doubt, because of the smaller number of cases, but equally, no doubt, because of the differential effect of mental disturbance on the test scores of individuals. Among the top scorers on the Vocabulary and Arithmetic tests there are proportionately *more* people as age increases, which implies a retention of ability *at this level* right up to age 60+. The other two tests conform more to expectation, showing a gradual decline with age at all ability levels. In the Mechanical Test there are more younger than older patients at the lowest score levels, which is rather the opposite of what one would expect.

Linked with the question of intelligence level and its relation to age is that of schooling. The number of secondary-educated patients in this survey—though only 32 in number—show substantially higher scores on all tests except the Mechanical, where they have no advantage at all. It looks, therefore, as if they have maintained their relative position despite advancing age, hospitalization, and mental deterioration.

THE EFFECT OF HOSPITALIZATION ON TEST SCORES.

Similar low correlations appear here also, i.e. between test scores and length of stay in hospital, Matrices again being highest, with an r of $-.21$. It appears, therefore, that among those patients who are capable of doing the tests, length of hospitalization *per se* does not bring about poorer results.

Using the method of Multiple Correlation to ascertain the combined effects of age and hospitalization on scores, we find the following figures: Matrices $r \text{ } -.44$, Vocabulary $r \text{ } -.16$. Again, the figures on three of the tests are too small to be of much significance. On the Matrices Test there is a significant drop, which confirms impressions gained during the testing. For older, long-term patients, therefore, this test is not suitable, and either the Vocabulary or the Arithmetic Test has a better chance of success.

WARD DIFFERENCES.

In all mental hospitals there is some attempt at grading or segregating patients, the principles followed varying from place to place, but the main general principle is according to degree of disturbance and nursing required. The empirical system in this hospital has grown up over a period of years. Patients are transferred from ward to ward by medical officers, often on the recommendation of senior nursing staff with long experience. For the first time an opportunity has occurred for an approximate correlation between the results of the system and an objective, if narrow, criterion. The test results for the different wards were separated, added to the percentage of test failures, and a combined rank order arrived at. The outcome, though primarily of internal interest, is perhaps of sufficient general interest to warrant another, and final, table, which shows a gratifying correspondence between the two independent methods of assessment.

In the table the best ward—on test—comes first, and the rest follow in descending order. A short description of the type of patient on the ward is given in each case.

TABLE V.—*Combined Test Results for Different Wards.*

Test order.	Type of patient.	Average age.	Average hospitalization in years.
1	Voluntary Admission and Active Treatment Ward	31·8	·25 or less
2	"Self-governing" Ward, but with many patients unable to leave hospital for good reasons	51·2	11·6
3	"Workers" Ward	45·9	5·7
4	Certified Admission, Observation, and Treatment Ward	43·0	5·0
5	Chronic, mostly well-behaved	44·8	9·5
6	Chronic, mostly well-behaved patients, somewhat older	50·9	9·4
7	Main "Disturbed" Ward	41·1	8·8
8	Chronic Annexe	49·2	13·9
9	Chronic Ward, with some disturbed patients	41·0	9·4
10	Chronic Annexe, with about one-third disturbed patients, seniles, and deteriorated cases	54·8	13·4

THE "EASY-DIFFICULT" RATIO AS A MEASURE OF MENTAL DISTURBANCE.

I had hoped, in view of the marked differential results, to find a ratio which might measure progressive degrees of mental derangement, weighted for age and hospitalization, but such a ratio would not fit into a neat numerical scale, in step with deterioration. An experimental ratio was, however, worked out and applied to the different wards. First of all the grade percentages for each test were weighted from + 3 for Grade I, to - 3 for Grade V, and the

resulting indices for the two "Easy" tests were expressed as a percentage of the "Difficult" indices. The rank order of these figures did show a trend, as follows: the greatest discrepancy between "Easy" and "Difficult" tests occurred in the voluntary admission, workers' and main "Disturbed" wards, while the least discrepancy came from the more chronic wards. It may be, therefore, that while most mental patients show these differential abilities—or disabilities—with poor reasoning ability all round, the earlier and "livelier" patients are comparatively well preserved in the more automatic functions, while increasing deterioration narrows the gap to zero, or up to the point at which testing is not possible.

DISCUSSION.

The experiment described above was a new one for most of the patients, who had never been subjected to group tests. On the whole, the testers were well received, even, in some cases, being asked when they were coming again!

Although the over-all results were poor in comparison with those of normal people, I feel sure that they are better than many lay people would be inclined to credit them with. The element of surprise was not lacking; now and again an apparently deteriorated patient gave a good test performance. That the tests showed differential results is no surprise, but the close similarity in score distributions between the two "Easy" tests, and between the two "Difficult" tests was not expected. There is more than a grain of truth in the saying "He has lost his reason," and this can occur at all ages. With increasing age and chronicity more than reason is lost, though it may be that in many of these patients it could be regained.

In this group of patients the number known to have cerebral lesion, of one kind or another, is small. Yet on the type of test-pattern which predominates in this survey, many a patient must have been labelled "Organic," and on tests which take much less time to do. It is obvious that functional and organic impairment can and do produce broadly similar test-patterns; and it is only in more intensive and detailed surveys that we can expect to differentiate the two. Functional deterioration is a complex affair, and may have many different causes, e.g. failure of volition, distractibility, replacement of systematic by autistic thinking, retardation, breakdown of associations through 'Inhibition,' conscious and subconscious negativism, and so on. If the right treatment is found in an individual case, deterioration is reversible, while, in organic cases, it seems that the most that can be hoped for is arrest. Recent experiments in this hospital have shown that certain drugs in combination can temporarily restore "lost" mental faculties in untestable patients.

In presenting these results I wish to thank Dr. J. J. O'Reilly, Medical Superintendent of Winson Green Hospital, for permission to obtain and use the data; those male nurses who gave such valuable assistance in interviewing and testing; and, finally, the Admiralty, for permission to use the Bennett Mechanical Test, Naval Version.

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THE PSYCHOLOGY OF ELECTRIC CONVULSION TREATMENT.*

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THE electrical method of inducing convulsions grew out of the use of convulsant drugs. Experience with E.C.T. has not proved that it is therapeutically superior to the chemical methods. One must, therefore, attribute the now almost universal use of E.C.T. to its technical and psychological advantages.

Early papers on the psychological aspects of cardiazol therapy drew attention to the intense fear and apprehension occasioned in the patient immediately before the onset of the fit. Cook (1940) described the frequency and the intensity of this fear, but he did not think that it was responsible for the patient's improvement. Rankine Good (1940) made observations on the nature of this subjective fear and emphasized its intensity.

There is no doubt that patients undergoing E.C.T. do not experience the powerful conscious fear which assails the patients after receiving an injection of cardiazol. Nevertheless, a strange fear, which amounts to a nameless dread, frequently afflicts patients who are about to undergo electrical treatment. As I shall show later, fear may well be an inescapable psychological accompaniment of the physical treatments.

The psychology of the cardiazol fit was studied by Schilder (1930) and Jelliffe (1937). These observers referred to the significance of the death threat from cardiazol and the subsequent rebirth which takes place on recovery, comparing this to the epileptic fit.

Plaut (1948) refers to the collective aspects of physical treatment, drawing attention to the fact that patients not having them regard themselves as having no treatment at all. He makes some clinical observations on the fear component of E.C.T.

We must conclude, from our survey of literature, that so far very little is known about the psychology of the actual treatment. There has been a vast amount of research on its physical nature. We know how the functioning of the frontal lobes is altered, how the hypothalamic and sympathetic nervous systems are stimulated, how the vagus autonomic recovers and the function of alimentation returns. The results of this organic research have greatly assisted our scientific understanding of the physical treatments.

On the psychological side there has been a general tendency on the part of psychiatrists to wish to diminish the fear associated with the treatment, though this seems to have been done more for humanitarian reasons than any

* Expanded from a paper read at a symposium held at Warlingham Park Hospital on 23 November, 1949.

other, since, apart from Cook's observations on cardiazol, there is no guide as to whether the fear associated with E.C.T. is valuable to the patient or not.

The modern trend in psychiatry is to consider the psyche and the soma together, and not to treat them as separate entities. Even in mental states which have purely organic causes, such as those occasioned by cerebral tumour or general paralysis, we should not confine ourselves to the somatic aspects of the disease alone. Clinical psychological studies, when correlated with the organic material, have greatly helped in the understanding of the functions of different areas of the cerebral cortex. This paper represents an attempt to formulate a more complete hypothesis about electric convulsion treatment by considering its psychological aspects.

E.C.T. produces unconsciousness followed by a period of confusion, and it is accompanied by a retrograde amnesia which may be sufficiently complete for the patient to affirm that he has not had the treatment. Psychological studies made at the time of treatment are therefore of limited value. Almost all the material obtained from patients for this study was obtained at least 24 hours after any one treatment. The psychological material is derived from the subjective experiences, dreams, phantasies and inner feelings of a large number of patients, a few of whom have been selected for more detailed study. Nevertheless, some interesting information can be obtained before and after the treatment is given.

Before treatment there is nearly always some nervousness, apprehension, or an unnamed dread of the unknown. The connecting of the head to a piece of scientific apparatus is in itself a threat to the patient. It is met in other similar procedures, such as X-rays or E.E.G. The process symbolizes the mind becoming subject to the machine, and this causes a personal resentment which arises out of a collective feeling that the intellect should always be master of the machine. No doubt the memory of these few moments before the current is applied would always be fearful, except for the merciful amnesia which usually causes the patient to forget how he felt the previous time. After the fit the patient is temporarily confused and disintegrated. Regressive phenomena, signified by infantile statements and calling for the mother, are common. The same occur after epileptic fits. Amongst male patients I have frequently observed homosexual utterances and behaviour. Two of these patients, at least, seem to regard the whole treatment as a homosexual experience. Some patients recover quietly, whilst others show varying degrees of restlessness up to states of considerable excitement. I have observed that paranoid patients and those who consciously object to being in hospital, and to treatment, and depressives with much introverted aggression, are those most liable to a restless or violent recovery. Prognostically, a restless recovery is somewhat favourable, as it occurs more often in recent recoverable cases and less frequently in chronic or deteriorated patients.

The following case studies were compiled from some detailed work on 6 patients, 5 of whom had E.C.T. Four out of these 5 were schizophrenics, the fifth a manic-depressive. Schizophrenics predominate in the choice of patients, because their introverted natures render it easier for them to describe the psychological processes under consideration.

The first 2 patients illustrate some aspects of the changes which occur at the instinctual and emotional levels during treatment. I make a clear distinction between instinct and emotion, although this view is not accepted by some of the academic psychologists. The dynamic psychologists, among them Freud and Jung, have recognized that emotion is the tension or feeling tone which normally accompanies an instinctive action. Jung recognizes thinking and feeling types as opposites, without indicating that instinct is more or less powerful in the one or the other. My own observations suggest that consciousness and civilization have brought emotion and instinct close together. They are more clearly separated in naïve and primitive types of people, and they become widely separated in psychosis. One of my patients quite unconsciously turned and fled for a considerable distance after a young man had unexpectedly kissed her hand. When she looked round she was, for a moment, surprised that he had not followed her. This instinctive awakening of the desire to flee and be chased was unaccompanied by any emotion, and was carried out without awareness of what she was doing. Furthermore, psychotics and primitives themselves subjectively distinguish instinct and emotion. Analytically, dream experiences confirm this distinction.

The first of these is a married woman of 27 years of age, who was a member of a large working-class family. Her first child died 4 months before her admission to hospital. She was pregnant at the time, and 6 weeks before her admission her second child was born. Following this event she lost all her feeling and became hopeless and unable to take any interest in her household duties. She felt profoundly guilty about the death of her first child and thought she was a murderess. Her father became mortally ill and she had thoughts of wishing to kill him.

On admission she believed she was in purgatory and that she was to be punished for her crimes. All the patients were in hell waiting for execution, and the food and medicine became poisonous. She talked continually about losing her soul—a statement which should be taken seriously, as it was a real manifestation of her psychosis. She thought she was condemned to a soulless existence and would never discover the meaning of life.

After admission she had 6 E.C.T.'s. She described how, during this period, God came to her in the form of electricity and that one night, after treatment, she underwent a translation. Her body became lighter and she felt almost separated from it. At the same time something happened in her head which she could not easily describe. It seemed as if her head wanted to contain her body. In this experience God took away her womb, causing it to descend into the earth. After the course of electrical treatment she felt she was still without her womb, and produced as evidence the fact that her periods had ceased.

These events may be interpreted by saying that, although this patient's immediate depression lifted and that her thinking (i.e. the head), was freed to some extent, she lacked life and feeling. The instinctual life was even more depressed. This could be confirmed clinically. She was relatively better, but took no interest in everyday happenings. When she heard that her father had died she had no feelings about it. Then she had a course of insulin treatment, and after 27 comas she was much the same. She said that she was convinced she was being condemned to a soulless existence; she greatly feared becoming a lost patient and she felt she was under sentence of death for having wished to kill her father.

It was decided to give her combined insulin and E.C.T. After 3 E.C.T.'s, given in insulin coma at 3-day intervals, she had changed very considerably. She felt more alive. She was talking to people about everyday things and, instead of reading the Bible practically all the time, she took an interest in newspapers and magazines. She was prepared to accept this emergence of her more natural self. Further treatment resulted in some rather stormy happenings. She became too elated about everyday events and wanted to rush off and run her home again with excessive zeal. Finally, she made a good adjustment, and she has recently

written saying that she is looking after her home and is very well. Before she left hospital she affirmed that her womb was in its usual place. "I can't understand saying that I had lost it." She described how she now "washed because her skin felt dirty and not because it was time to do so."

This woman, then, was dead emotionally, cut off from her instinctual life, and consciously utterly depressed. The first course of E.C.T. failed to free the instincts. This may be regarded as usual; in fact, in this case, the instinctual and creative life became pushed further down, but it also failed to liberate the patient emotionally, which was unexpected. It only produced an inflation of the head which temporarily lifted the depression. Insulin certainly failed at first, as it usually does, in the face of profound depression. The combined assault of E.C.T. and insulin was required for this patient, and resulted in recovery. In her dreams before treatment she was frequently an angelic creature floating in heaven, but after treatment she started to dream about her family and her father and mother. Before E.C.T. she felt isolated and cut off from the family groups. Treatment initiated her into these circles again, and it also restored her married status to her, which she believed she had lost.

The second case is a married woman of 28 years. She has 3 children; the first 2 are 10 and 6 years of age, respectively, and she has a baby a few months old. Her first symptoms occurred shortly after the third child was conceived, when she experienced a loss of feeling towards her husband. During her pregnancy she gradually lost her feeling and enthusiasm for everything. A week before the baby was born she became ill and depressed, and the acute stage of the illness dates from then. After the child was born she had 8 E.C.T.'s, but there was no improvement. She was acutely aware of this loss of feeling and greatly desired to become an ordinary person and to get back to being an energetic housewife again. She affirmed that her body was physically strong and healthy, but that the weakness was in the head, which seemed hollowed out. She had no conscious aspirations to greatness. She started insulin treatment, and after 18 comas there was very little change. She had no particular experiences or fear during recovery except that after coming round she felt less real than usual, i.e. rather worse. She was very regressed, trying to maintain her integrity by recapturing past events in her life.

Combined treatment was then started. After only one treatment she became less regressed, turning her attention to matters of the moment and becoming concerned with domestic affairs. She says that her head, which had become hollow, was filling again. Her body still lacked feeling. After a course of combined treatment this patient completely recovered her lost feeling. Her only complaint was some defect of memory. She helped efficiently in the insulin ward, and eventually went home to her husband and children.

These 2 patients were superficially similar. Both are young married women. Both have a depressive schizophrenic type of illness shortly after the birth of a child. Both these patients have E.C.T. The first patient temporarily loses her depression and becomes clinically improved. The other becomes rather worse. The first patient had a rich phantasy and emotional life, and she was cut off from the instinctual level. E.C.T. destroyed her aspiring phantasies and partly freed her emotional life, but depressed the instincts further. The result was a temporary elation. It required insulin, which frees the instincts, combined with further E.C.T., to restore this patient completely. The second

patient had a rather poor phantasy life, which may account for the poor response to the first course of E.C.T.

In the next 2 cases we shall see more specifically what happens to the phantasy life of the schizophrenic during E.C.T.

The first of these is a young man of 20 years of age, whose parents live in Scotland. He came to the London area to work as a student in the British India Bank, and he proved intelligent and carried out his duties efficiently. He had an acute breakdown in August of last year and came into hospital shortly afterwards.

On admission he was in a state of acute catatonic excitement, being very hostile and aggressive, believing that he was sent on a special mission and that the hospital authorities were obstructing him. He had for many years lived in a world of imaginative phantasy which never became translated into experience. He used to describe himself as the man who was capable of action and leadership. The Navy, with the opportunities afforded by brief acquaintance for boasting of this sort, gave him a further outlet for describing himself as a heroic young man. In particular, he represented himself to his fellow-seamen as a Casanova among men. His sexual phantasies were very real and powerful, but he never had any girl friends and never had any intimate relationship with women. After he left the Navy he became interested in politics and evangelical religion. He was disappointed to find a lack of interest in the organizations he joined. He saw himself as the leader of powerful religious crusades. Then he became the centre of hostile elements and the projected paranoid forces began to circle about him. People would laugh and talk about him, but it was doubtful whether any particular organization was the object of his paranoia. So we see the phantasy world being expressed in an identification with collective systems. Just before his final breakdown an elaborate symbolism affected him and he became particularly involved with numbers. The most important of these was the circle which, in the ascendant, signified the number 7 and the world of God. When this symbol rotated he became possessed by it, and his soul became drawn out of his body, which was left dead and abandoned. In the opposite the circular symbol signified hell. His breakdown was characterized by violent and aggressive catatonia. He was God and the devil, and the opposites of good and evil, heaven and hell, battled in his head.

He was admitted to hospital and had 6 E.C.T.'s which resulted in dramatic improvement. He was terrified of the treatment, and I, who was giving it to him, became the black devil who was to sacrifice him. Afterwards he had a dream that he had been a great and important person, and that E.C.T. came from a realm which caused him to crash into hell. This hell was the ward in which he was when he first came to hospital.

At the time of writing he has just started insulin treatment. He states that the experience in the ward where he had the E.C.T. has destroyed his phantasy world and put him in touch with reality. Of course, this has accentuated his inferiorities. He sees himself as an ordinary fellow, and he is now outside the circular figure. Previously it was like a bicycle wheel, revolving about him and having a bulging tyre about to burst. The loss of the phantasy world has placed him in contact with a rather chilly reality, which at times assumes the proportions of hell. E.C.T., he says, has brought about this sacrifice, insulin will ensure his rebirth.

It seems that this is, indeed, just the task of E.C.T. for these patients; to destroy the phantasy life and to bring the patient into touch with reality. This patient has experienced some increased life at the emotional level, having better feelings towards other people. But at the instinctual level there is still a grave lack, and we must look to insulin to do this for the patient.

The next patient shows a similar mechanism. He is a young man of 25 years of age. He has superior intelligence and possesses a University degree. He had 2 schizophrenic breakdowns before he went up to Cambridge, and has recently had a third. His personality is characterized by a great desire to perform social works

and to save others, and to live the life of the underdog. During one vacation he lived in a bombed mental hospital in Hamburg and worked as a mental nurse. A more recent ambition was to work at the coal face to get the feelings of a miner. His breakdowns are characterized by intense religious fervour. He becomes the builder of a new religion and he is a new Christ. He spends many hours praying for his family and for the world.

He was in this state on admission, looking very schizoid and withdrawn. He was very difficult to contact, and would fall on his knees for long periods in an attitude of prayer. After 4 E.C.T.'s he was clearly developing an increasingly hostile attitude towards me. I had become to him the medical scientist without human feelings. He accused me of destroying something of great value to him. This was true. I found that I had destroyed his world of religious experience and phantasy. He said he was being compelled to be an ordinary man, and the consciousness of his weakness was almost too much for him. The visionary inner world had vanished, and with it had gone his power. [I have come across this in other patients after insulin, as well as E.C.T., e.g. one girl who in phantasy was the mother of Christ, and who had the power to heal all the patients in the hospital, recognized that insulin was responsible for her losing this phantasy power.] To return to our male patient—he was transformed clinically. He became energetic, co-operative and pleasant to talk with. He also told me that E.C.T. had increased his awareness of the body. Appetite and bowel feeling returned, and he also realized that his bladder sensation had come back after being absent for many weeks. He accordingly took more care over his bodily cleanliness and personal appearance. All these matters had been impersonal and automatic during his illness.

In this case we can see again how E.C.T. breaks up the phantasy world. After I had given him E.C.T. he did not actually regard me as the devil, but I was somewhere near it, e.g. I had made religious experience impossible and had induced a rebirth of life to the flesh which he had previously tried to mortify.

The fifth patient did not have E.C.T., but she provided the following material. She is a single woman of 29 years of age, who is intelligent, worked in the Bank of England, and developed a schizophrenic breakdown which has now lasted more than a year. She was sent for analytical treatment to another hospital, and after spending 6 months there, was transferred to this hospital for insulin treatment because her psychosis was becoming manifest.

This patient has not had E.C.T. but, whilst she was at her first hospital, she noticed that patients receiving analytical treatment were occasionally subject to electrical treatment. This state of affairs activated her mind, and she had the following interesting dream that she herself was having E.C.T. She was waltzing intermittently with a patient who was undergoing treatment for a puerperal psychosis. Then she was pushing this woman's baby in a pram, and again waltzing intermittently. Then her friend was in trouble and she had to run through the hospital to save her. At this point she was suddenly seized upon and given E.C.T. There was a gigantic access of natural power which seemed to come from within the earth. There were tall buildings which were shattered and fell, and civilization crumbled. She feared that her own identity would be broken up. She called out "with a loud voice" her own name; this was not enough and she called out "Jesus Christ," and this seemed to save her.

She wonders whether this E.C.T. power came from the devil or God, but is inclined to think that it is the terrible power of the angry God. To her, the devil is somewhat flimsy before this great force. At the time she was very much identified with God and wished to have His power. She felt that to have this unlimited strength was most attractive. But this strength of God is the power behind the Germanic Hitler. Hitler was limited by having to count on material forces. The phantasy power urging him on has this vast strength that could blot out civilization in a single stroke.

She sees herself in the saviour role (i.e. of saving her friend). Then she becomes sacrificed to the vast collective natural world and sees herself as Christ dying, and

with her intellect dissolving. But she would also like to have this natural power, and it is interesting that E.C.T., by awakening the natural feelings, can help to bring the patient out of a depression in which she feels buried beneath the earth.

The practical effect of this unconscious attitude to E.C.T. was to make her fear that her doctor would suddenly descend on her and give this treatment. The doctor then became a wielder of great power, rather like a German dictator, who could irrationally break off analytical treatment, to condemn her to disintegration.

The sixth case is a young man of 29 years of age, suffering from manic-depressive psychosis. He has had several attacks of mania and depression during the past 3 years. In the elation he becomes acutely psychotic. During a recent attack of mania his main delusion was that he was being watched and attacked by Gestapo and Soviet police agents. He related the incidents to a visit he paid to Germany in 1938. He had sometimes told me about this tour of the Rhineland, and his ordinary sane description of it contained no sinister elements. During his ascent to mania he told me the story again, filling it with dark men, Gestapo agents, who watched him—and friends who silently turned into foes. Then the ward sister and male nurses, and myself, became Gestapo agents. All dark-haired people were regarded with suspicion. I was the chief Germanic demon, as I was the wielder of E.C.T. which came to him as the destroyer of this phantasy. Certainly intensive E.C.T. and sedation cut short this particular attack of mania. If we see E.C.T. as the destroyer of phantasies it becomes easier to see how it assists both phases of the affective states, the depressed and the elated.

Having described the experiences of these 6 patients, we are in a better position to understand what E.C.T. does and to differentiate its functions from the effects of insulin.

The schizophrenic is cut off from the driving force of his instincts. This may be innate, as in hebephrenia, where there is a primary defect of instinct, or it may be environmental, where the psychological milieu is disturbed and instinct is rejected. Corresponding to this there is disorganization and frequently depression of the emotional or affective life. The head, as the seat of the intellect, creates a world of erotic and exalted phantasy. The patient is frequently identified with some person of world importance, or with Christ, or, in the case of a woman, the Virgin Mary. The unbelieving world drives the patient further away from reality. Because a man devoid of instinctual force must remain close to the mother elements, the patient again takes refuge in phantasy. The phantasy must be exalted, because the schizophrenic has a certain position to maintain. The patient can no longer work and face the world—he therefore takes refuge in a mental hospital. We start off, perhaps, by giving him E.C.T. What happens? Here are my conclusions about schizophrenics. First, that E.C.T. destroys this phantasy world and restores feeling at a higher level than the instincts. Both these transformations bring the patient into touch with reality, often so stark as to be interpreted by him as hell. These patients are still out of touch with their instincts, and to restore these is one of the functions of insulin. Thus, most schizophrenics require the ground won by E.C.T. to be extended and consolidated by insulin. My second conclusion about schizophrenics is that those with a strong affective component respond best to E.C.T.

I believe we should make more use of the Rorschach test. Rabin (1947)

has already shown that patients who gave the greatest number and range in the colour-shading and movement responses do best with E.C.T., and that these patients show a further dilatation of these particular responses after treatment.

The first patient of the series I described had a strong affective side to her nature, which had become split off and lost to her. E.C.T. restored this temporarily. It was clear, from her subjective account of the loss of her womb, that her instinctual life was buried, and it required insulin and E.C.T. together to restore both these functions.

The second patient, as we saw by the Rorschach tests, had a weak affective life, and her first course of E.C.T. did not help her. I am inclined to think that this woman would not have got better without insulin.

My third conclusion concerning schizophrenics, results from considering the extraordinary dream of the patient who did not have E.C.T., but who was in contact with the atmosphere of the treatment. It is interesting that in her dream she experienced almost exactly the subjective impressions of a patient who has actually had the treatment. If such an inner experience corresponds so well with the E.C.T. one, we must believe that E.C.T. is psychologically "right." She was the saviour, the mother of the world, and the God or devil of all power came and destroyed her phantasy world and brought her in touch with reality. This in fact happened to her, exactly as if E.C.T. had been responsible for it. Her inner experience is strikingly similar to that of the young bank clerk, who is the third of the series, the only difference being that he had actually had the treatment.

Fourthly, E.C.T. does not influence schizophrenic regressions. When our bank clerk arrived in hospital he was in a severely regressed state. He would, in his quieter moments, sit in the safety room in a cross-legged position, saying that he was in his mother's womb waiting to be born. When he had recovered his sanity after E.C.T., the Rorschach test was very disintegrated and indicated that he was still potentially regressed. This tells us that we are dealing with an essentially hebephrenic state with a poor prognosis. I believe that E.C.T. does nothing to help regressions, which are at the instinctual level. Insulin does do something to get patients out of regression, as R. D. Scott has shown recently.

Fifthly, we need to consider whether E.C.T. produces the most permanent form of remission in schizophrenics. Here we witness the divergence of the physical and the analytical approaches. If I had given E.C.T. to the schizophrenic girl whose dream was presented above I should have expected the phantasy world to break up and disperse, and I should have been thankful to achieve this. If I had been analysing her at the time I should have insisted on going further. I should regard it as essential for the patient to come to terms with her hard crash to reality, and I should have wanted to know what had happened to the phantasies. Looked at either way, this patient was not cured. To return to reality frequently leaves these persons more unstable than before. Experience with insulin has shown me that reactivation of the primitive urges is the essential psychological feature of this treatment in cases which recover. On these theoretical grounds one would not expect E.C.T.

to produce any better results in schizophrenia than those arising from spontaneous remissions in hospital. This seems to be the case. Linford Rees (1949) states that "deep insulin treatment is the only method giving a significantly higher proportion of recoveries than the control group." This conclusion was based on careful clinical and statistical studies. The value of E.C.T. in the treatment of schizophrenia is for the most part limited to cutting short the initial acute psychotic phase. It is of the greatest value at this stage, as it reduces the length of the illness and enables the patient to become manageable in the insulin group. I have seen a few undoubted schizophrenics in which E.C.T. was the treatment of choice, and in which it was superior to insulin. These were mostly simple types of schizophrenia with well-marked schizoid moods and catatonic elements.

The result of treatment in manic-depressive psychoses is easier to understand psychologically. The archetype of depression is at the emotional level. Since the feelings are the handmaid of instinct there is an apparent depression of the latter. The depressive feels that his depression has ruined his whole life, that it will last for ever and that nothing can get him out of it. The patient's loss of feeling is at the alimentary level. There is loss of taste, of appetite, of bowel sensation. The patient may believe that his bowels are stopped up and will not work. There is such a close connection between alimentation and social relationships that it is not surprising that these patients feel dead and worthless, unable to take their place amongst other men and women. The depression undoubtedly floods over the intellect, so that the patient may believe that his brain is worthless and that he is a criminal.

E.C.T. given in the depressed phase has a direct effect in stimulating this emotional life, thus restoring feeling and a sense of reality. Sometimes the results are too dramatic, and much excited feeling exalts the head, producing a temporary hypomania.

In the manic phase E.C.T. seems to break up the exalted phantasies, just as it does for the schizophrenic patient. Afterwards the patient remains unstable, inclined to further attacks of mania, until the disease has run its natural biological course.

Now we must give a little attention to the psychological value of the fit itself. The fit is an epileptic fit. There is a sudden loss of consciousness, the voluntary muscles are involuntarily convulsed, and the breathing temporarily stops. In epilepsy the patient is in real danger, he may fall and hurt himself, sometimes seriously or fatally. It has been suggested by some that the E.C.T. fit is in the nature of a substitute for the sexual orgasm, the idea being that the patient's sexual life is thus re-awakened. I have no evidence that this is so. E.C.T. does not produce many changes at the instinctual level; it may even depress activity at this level still further. We know, from our experience with curare-modified E.C.T., that the muscular convulsion itself plays no part in the result, although the rhythmical discharge from the cortex may be important. The sudden loss of consciousness and nearness to death, which a major fit entails, seem to be important factors psychologically. Thus, profound unconsciousness and temporary cessation of respiration seem necessary. I do not know whether a rhythmical discharge from the cortex is in itself valuable.

As a major fit must almost always occur in order to fulfil the first two of these conditions, I am inclined to think that cortical discharge is merely an incidental encumbrance.

Few writers seem to have looked into this problem. Remarks by Schilder and Jelliffe have been referred to earlier in this paper. Edelston (1949) reports on the analysis of a case of hystero-epilepsy. In his view, the fit itself is a substitute for crime, possibly a sexual act looked upon as a crime. The fit is often caused by the fear of divine punishment, and symbolizes guilt, punishment and death.

The epileptic who unconsciously accepts his fits in this light is liable to remain within or near the compass of his psychosis. I have evidence that when the patient accepts E.C.T. in the same sacrificial way the prognosis is not ultimately good, although temporary improvement may occur. Where the treatment brings fear which is fought vigorously, and the patient can endure the crash of his phantasies, the immediate prognosis is, in my experience, almost invariably good. At the commencement of this paper, reference was made to fear. It must be made clear that the patient undergoing cardiazol treatment has a most devastating experience of fear of an entirely conscious kind. With E.C.T. the picture is different in that the nature of the fear experienced becomes unconscious, due to the retrograde amnesia which accompanies the treatment. Further, patients experiencing fear of E.C.T. can seldom say exactly what it is that frightens them. Arguing from this, we cannot assume that, because we prepare a patient for E.C.T. by giving him thiopentone, we have in any way diminished his unconscious fear.

Looked at analytically, there is something to be said for allowing a patient to experience a certain degree of fear. This serves to orientate the patient towards the treatment and to the doctor who is giving it. Even if this produces a state of hostility, it is certainly better than the more complete subjection which must take place when the patient is, for example, premedicated with thiopentone and curare. I am not prepared to say that it is fear which produces benefit from E.C.T. But I have observed that those who fear E.C.T. most are acute schizophrenics who are identified with a high figure, usually Christ. These patients usually do very well on this treatment. Subjectively, E.C.T. becomes the work of the devil—often a devil of the Germanic pattern. Further the doctor becomes this devil, and the patient will often become severely paranoid about him for this reason. This process, bringing with it the crash of the ambitious phantasies, is a fearful thing—it is far worse than being made unconscious. Many patients are not so much afraid of the machine itself, but of the inner experience wrought by the treatment. Fear is a necessary accompaniment of the treatment, but it is not the treatment itself.

Finally, all the major organic treatments of recent times have carried a hidden menace. X-rays may cause cancer or distort the human embryo. Blood transfusions with rhesus-positive blood may sensitize a rhesus-negative woman, whose children may afterwards succumb to haemolytic jaundice, or, if we keep them alive, to mental deficiency. Sulphonamides bring up the questions of sensitivity and sterility. There is now some question about the more potent ovarian hormones causing permanent sterility. Of penicillin

and the antibiotics, we can only guess the hidden dangers, but we already run the risk of producing a strain of streptomycin-resistant tubercle bacilli. It may seem reasonable to wonder what lurks behind E.C.T. We should learn more as to what psychological and physical trauma may result from being rendered unconscious and convulsed on numerous occasions.

For many years psychiatry lacked the technical means of grappling with mental disease on the physical plane. Psychiatrists were not idle then—there was a vital need to understand insanity psychologically. The physical treatments have entirely changed the outlook. I would like to suggest that we should not relax our efforts to understand the process of cure psychologically even when it is being brought about by physical means.

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CEREBRAL DYSRHYTHMIA INDUCED BY PHOTIC AND CHEMICAL STIMULATION AS A METHOD OF TREATMENT IN PSYCHIATRY.

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INTRODUCTION.

METHODS employed in convulsion therapy have undergone many changes since the development of this treatment by Meduna in 1933, using oil of camphor as the convulsive agent. More efficient analeptics such as cardiazol and ammonium chloride soon displaced camphor, and they in their turn have gradually, although not entirely, fallen out of favour since the introduction of electrically produced fits by Cerletti and Bini in 1938. Curarization as suggested by Bennett in 1940, has certainly minimized some of the dangers but, on the other hand, often requires more staff than are available if large numbers of patients are being treated in the one session. In addition, the mental confusion, frequently prolonged, following any form of full convulsion therapy, may give rise to difficulties of an administrative nature as, for example, in out-patient E.C.T. It is in order to minimize these disadvantages that an alternative method has been sought.

For many years it has been known that photic stimulation could produce fits in certain persons who were suffering from epilepsy, and in connection with this, Gastaut, concurrently with Grey Walter, employing visual stimulation found it possible to distinguish photogenic epilepsy as a distinct group.

Also, Cossa and Gastaut have found that intermittent photic stimulation in normal subjects lowers the convulsive threshold to metrazol so that the injection of 4 c.c. of the drug is sufficient to produce a convulsion without the apprehension which makes routine metrazol treatment so terrifying to the patient. Following the publication of their work it was decided to try the method as an alternative to E.C.T., and also to attempt to avoid the production of a full convulsion, using the cortical dysrhythmia as observed on the E.E.G. recording as a control. It was found that slightly more than half the convulsive dose of the analeptic was required with the visual stimulation to produce the typical E.E.G. pattern, and that the period of dysrhythmia could be controlled by the duration of the visual stimulation.

TECHNIQUE.

Cossa and Gastaut commence visual stimulation from a stroboscope at a flash frequency of 15 f/s., after which intravenous injection of 4 c.c. of metrazol

is given. After 4 to 15 seconds myoclonic jerks appear followed by a full convulsion, whereupon the stroboscope is extinguished.

In our technique a standard dose of 1 c.c. of 5 per cent. hexazoletriazol in aqueous solution is given intravenously, which is followed 5 to 15 seconds later by photic stimulation, the frequency of which is adjusted to suit the individual patient, but which is generally 15 f/s. Clonic movements begin immediately or gradually in the facial muscles, simultaneously with a spike and wave pattern on the electroencephalograph. During the intervening periods between photic stimulation, the patient is fully conscious and complains only of slight dizziness, although this is not invariably present, but there appears to be little if any apprehension or unpleasant memory of the stimulatory phase, although patients usually say that they have had a queer and indescribable sensation when the light was flickering. The initial periods of photic stimulation last 1 to 5 seconds and are given at intervals of approximately 5 seconds. As the effect of the hexazole wears off, the periods of stimulation are lengthened up to one minute. By adjustment of the duration of the exposure to the flicker lamp, it is possible to keep the patient at the stage of myoclonic movements without the development of a full convulsion which is liable to occur when, initially, the periods of stimulation are too long or the intervening periods too short. In the occasional case that does not appear to be improving, the photic stimulation is continued uninterruptedly until a full convulsion takes place. The frequency of treatments is two or three times weekly.

SELECTION OF PATIENTS.

The majority of the cases selected were suffering from melancholia owing to the relatively favourable prognosis in this form of mental illness. Although all the cases were males, there does not appear to be any reason why similar results should not be obtained with female patients. Where a full convulsion is given, the contra-indications would seem to be similar to those which obtain when E.C.T. is used.

CASE HISTORIES.

CASE 4.—A male, aged 67, suffering from a severe agitated involutional melancholia associated with moderate arteriosclerosis, had been admitted to hospital 5 months previously following a suicidal attempt. Routine treatment with E.C.T. under curarization was attempted on three separate occasions, but a convulsion could not be produced. However, it was found possible to convulse him using 2 c.c. of 5 per cent. hexazole. Four such treatments were given with some improvement affectively, but the delusional system, featuring ideas of guilt and unworthiness, still remained. The following procedure was then carried out under E.E.G. control, the normal recording in this patient showing an alpha rhythm of 13 c/s. bilaterally symmetrical and a little theta rhythm in the left occipital region. 16 mgm. of *d*-tubocurarine chloride was injected intravenously, followed by 1 c.c. of the hexazole solution one minute later. Stroboscopic stimulation was then commenced at a flash frequency of 15 per second for periods lasting an average of 3 seconds, and for a total duration of 22 seconds, the intervening periods being from 3 to 7 seconds. Throughout stimulation, spike and wave patterns were recorded (Fig. 1). For 2 minutes immediately following the cessation of stimulation, a continuous high amplitude simple harmonic pattern with a fundamental frequency of 4 c/s. was shown. The next day no delusions were apparent, and clinically he appeared to have recovered. Six days later he was discharged at his own request

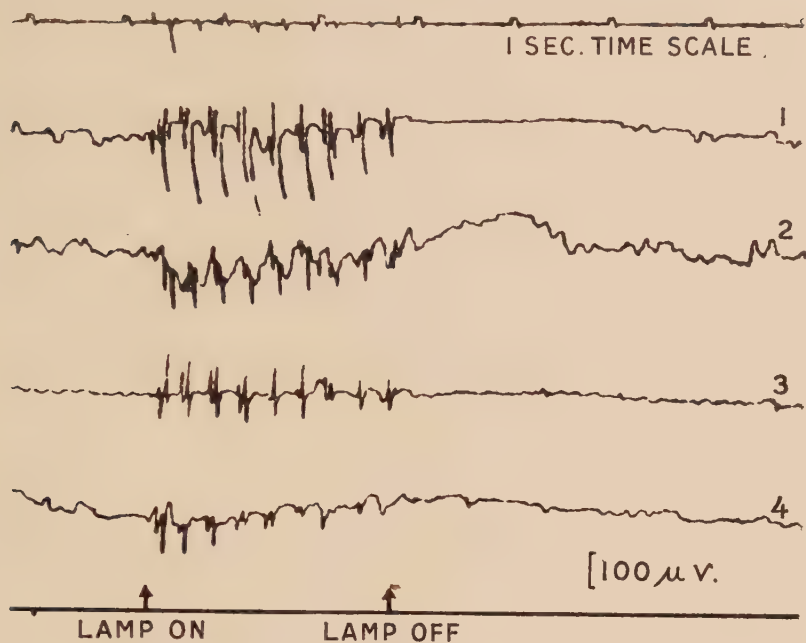


FIG. 1.

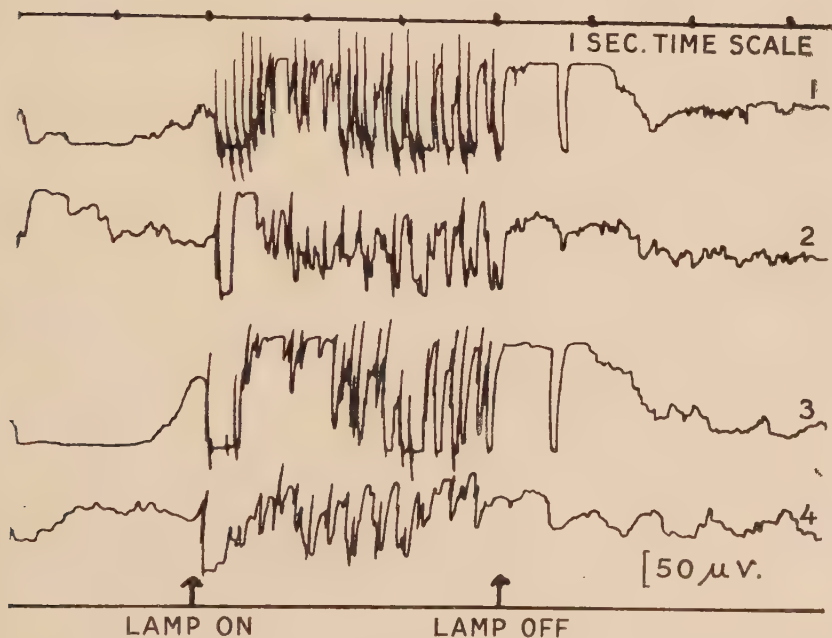


FIG. 2.

Leads in Figs. 1 and 2.—1, Right fronto-parietal. 2, Right temporo-occipital. 3, Left fronto-parietal. 4, Left temporo-occipital. Fig. 1 shows a typical spike and wave episode for the duration of stimulation. In Fig. 2 this is slightly masked by muscle activity. In both cases the record between stimulation shows increased delta and theta rhythm.

and is now, three months later, pursuing his previous occupation with no evidence of recurrence of symptoms.

CASE 18.—This man, aged 60, had given a history of three attacks of melancholia during the preceding 15 years, when admitted to hospital 14 months ago in an acutely depressed condition. In addition to mental signs such as preoccupation, reduced spontaneity, and delusions of guilt and poverty, he was moderately arteriosclerotic and had a right basal bronchiectasis. There appeared to be little change mentally after a course of 11 treatments with E.C.T. under curarization, so one month later he was given treatment on five occasions by the method outlined above, which included one full convulsion. No curarization was employed. The resting E.E.G. pattern was of a rather silent type with an alpha frequency of 9 c/s., and showed a typical spike and wave response on photic stimulation (Fig. 2).

One month later he appeared to have improved considerably. Spontaneous interest had increased, he was taking an active part in occupational and group therapy, and the delusional system had become less obvious.

COMMENT.

The number of cases are insufficient for statistical analysis of the results, but appear to compare favourably with those obtained with E.C.T. (see Table).

It was found that no general rule could be laid down for either the frequency of flash or length of the individual stimulations. Each case had to be taken on its own in regard to the prevention of a full fit, since some tended to become fully convulsed with shorter stimulation or intervening periods than others. The myoclonic movements were found to be the best indicator. When these began to be submerged in a tetaniform contraction, a complete fit was imminent and developed if stimulation did not cease at once. When the myoclonus was initially unilateral it was observed that simultaneously with the general spread of the movement, the dysrhythmia on the E.E.G. became generalized, and a full fit then developed. On the other hand, where the myoclonus was bilateral from the commencement of stimulation, the indication for cessation of the latter was the development of a generalized tonic contraction.

E.E.G. control was not found to be essential except in the preliminary investigation of the technique.

In connection with the possible mode of action of this method of treatment, it has been observed by Gellhorn that there is a diminution of sympathetic activity in functional mental diseases, and particularly schizophrenia, probably at a diencephalic level, and that each type of shock treatment produces a powerful stimulation of sympathetic centres, and also that observation of patients before and after shock treatment suggests an increase in central sympathetic reactivity with clinical improvement. Noting this, we have attempted to produce this effect by frequently repeated stimulation by a flicker lamp, using at the same time a drug which acts at the diencephalic level, in order that disadvantages associated with a massive electrical stimulus such as is given in E.C.T. or electronarcosis might be overcome. We hoped that by using frequent stimulation a summation of effect would occur, but further work is necessary to determine this, such as the effect on secretion of adrenalin, the blood-sugar levels, and the psychogalvanic reflex.

The failure to produce adequate therapeutic effect with repeated sub-convulsive doses of E.C.T. may be due to the period of stimulation being too

Case No.	Age	Diagnosis.	Duration.	Previous attacks.	Previous treatment.	Treatments given.	Flicker frequency f/s.	Remarks.
1	22	Schizophrenia catatonic	3 years	1	E.C.T.	3	15	1 full fit. Not improved.
2	52	Severe depression Suicidal	4 months	—	—	5	5, 18	1 full fit. Recovered.
3	34	Depression	3 "	2	E.C.T.	2	15	Discharged improved.
4	67	Severe depression. Arteriosclerosis	6 "	1	Hexazole convulsions	1	15	Discharged recovered.
5	26	Mild depression	2 "	2	—	2	15	" "
6	44	Depression	1 month	1	—	7	15	1 full fit. Recovered.
7	29	Schizophrenia. Catatonic	3 years	—	Insulin	6	15	Not improved.
8	59	Depression. Suicidal	2 weeks	1	E.C.T.	3	15	Discharged recovered.
9	46	Depression.	1 year	—	—	7	17	Improved.
10	21	Hypochondriasis	3 weeks	2	—	6	18	" "
11	26	Depersonalization Schizophrenia.	6 years	—	E.C.T.	4	15, 18	Not improved.
12	55	Hebephrenia	3 months	—	—	4	18	Discharged recovered.
13	60	Severe depression. Bronchiectasis	3 "	1	—	3	18	Improved.
14	49	Arteriosclerosis Depression.	1 year	—	E.C.T.	3	15	" "
15	30	Hypochondriasis Mild depression.	6 months	—	—	4	15	" "
16	24	Syphilophobia Schizophrenia.	3 years	—	—	4	15	" "
17	48	Catatonic Severe depression.	9 months	—	E.C.T.	4	15	1 full fit. Improved.
18	60	Agitated. Suicidal Severe depression.	1 year	3	E.C.T.	4	14	" "
19	52	Arteriosclerosis	3 months	1	—	3	17	Recovered.
20	63	Mild depression " "	2 "	—	—	4	17	" "

short and too infrequent owing to the dangers of cardiac irregularity and collapse. In stroboscopically induced dysrhythmia, the prolonged action of the analeptic on the diencephalic level causes a more marked and prolonged excitation of the brain and this, coupled with the frequency and duration of stimulation, probably accounts for the benefit obtained in contradistinction to subconvulsive E.C.T.

SUMMARY.

An account is given of a method of shock treatment using photic and chemical stimulation.

Full convulsions do not appear to be necessary for a full therapeutic effect. Myoclonus is suggested as a clinical indicator in place of E.E.G. control.

Results so far bear favourable comparison with E.C.T. although further investigation is required to support this conclusion.

We wish to thank Dr. E. U. H. Pentreath, Medical Superintendent of the Pastures Hospital, for permission to conduct this treatment and to use hospital records, and Mr. Fayers for the reproduction of the E.E.G. recordings.

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OBSERVATIONS ON THE EFFECT OF MYANESIN (3 ORTHOTOLOXY-1, 2 PROPANEIDOL OR TOLSEROL) ON EPILEPTIC THRESHOLDS AND SOME PSYCHIATRIC CONDITIONS.

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MYANESIN was first investigated in animal experiments by Berger and Bradley (1946) and found to have a curare-like muscle relaxing effect. This they thought was mainly due to action on the spinal cord, because strychnine convulsions were inhibited by the drug. Smaller doses were more effective for this than for the reduction of Metrazol convulsions. Hunter and Waterfall (1948) reported an immediate disappearance of epileptic seizures in man after intravenous administration of 4-1 gm. of Myanesin. Gammon and Churchill (1948) found that the spike and dome pattern of the E.E.G. in cases of *petit mal* disappears following Myanesin, whereas E.E.G. alterations associated with *grand mal* seizures were uninfluenced. Higher doses might, however, abolish these changes. Geer (1949) used the drug (in doses up to $3\frac{1}{2}$ gm.) in conjunction with electric convulsive therapy (E.C.T.) for mental disorders and found it of no demonstrable value because it apparently tended to make convulsions more severe, although it slightly increased the voltage time stimulus necessary to produce a convulsion. Unna and Kaplan (1949) examined the anticonvulsive properties of Myanesin in mice. Metrazol seizures of mice treated with Myanesin were seen to be at least as severe as controls and often prolonged. The tonic extensor phase was, however, eliminated. The death in Myanesin-treated animals was delayed as compared with controls. Electroshock also caused a seizure in 89 per cent. of the Myanesin treated mice, but no deaths occurred, whereas controls without Myanesin had a mortality of 33 per cent. Here, again, Myanesin appeared to abolish the tonic phase of the fit and only more violent clonic convulsions occurred. Schlau and Unna (1949) reported that the pattern and duration of seizures in E.C.T. in man were not changed following 2 gm. of Myanesin four times daily by mouth. They did, however, observe a shortening of the period of apnoea following the convulsion.

These previous somewhat contradictory observations indicate that a more detailed investigation into the influence of Myanesin on human epileptic thresholds should be of interest. In the present study the effect of the drug on the convulsive threshold in E.C.T. was compared with that on the Leptazol (Cardiazol, Metrazol) thresholds. It was hoped that some deductions on the mechanism of action of Myanesin might be made possible from such a comparison as the primary irritative lesion set in E.C.T. is a cortical one, whereas Leptazol primarily stimulates diencephalic structures and also produces E.E.G. changes resembling the dome and spike pattern of *petit mal* (Goodman, Toman and Swynard (1946) and others). Leptazol in larger doses does, however, undoubtedly stimulate the cerebral cortex (Toman, 1949) as well.

In the course of the present investigations, apart from the threshold comparisons, the effect of Myanesin on anxiety, tremor, obsessional mechanisms, hallucinosis and schizophrenia could also be studied.

METHODS.

E.C.T. convulsive thresholds were worked out beforehand on patients undergoing treatment by gradually increasing the joulage on different days until it was just high enough to produce a typical *grand mal* attack with tonic and clonic phase. A MacPhail-Strauss electroplexy apparatus was used for these investigations. The convulsive thresholds for Leptazol were obtained in a similar way, usually starting with 3 c.c., increasing the dosage by 1 c.c. daily until again a typical *grand mal* attack resulted. The Myanesin dosage given by mouth was higher than in previous investigations as will be evident from the tables. When the intravenous route was used Myanesin was injected very slowly over at least 2-3 minutes. Though toxic effects like thrombosis and haemolysis were observed in previous investigations following the intravenous use, none were seen in the present study except vomiting in two cases. The effect of a single dose was found to be comparatively short-lasting.

RESULTS.

(1) *The Effect of Myanesin on Convulsive Thresholds.*

Myanesin did not seem to alter the pattern of the fit consistently. The tonic phase, however, appeared sometimes shortened or did not occur at all in some cases. The influence on the Leptazol threshold, though significant, was not as strong as on E.C.T. thresholds. Here higher doses only rarely produced *grand mal* attacks, whereas with a higher dose of Leptazol a fit was usually obtainable.

TREATMENT I.

- = No response.
 + = Some twitchings.
 □ = Clonic twitchings.
 ⊕ = *Grand mal* fit.

No. of case.	Thresh- hold E.C.T.	Myanesin dosage.	Type of response.				Remarks.
			○	+	□	⊕	
1	J. 16	1 gm. 5 × p.o. previous day and 1 gm. ½ hour before treatment.	..	..	..	J. 16	
2	J. 14	ditto	..	..	..	J. 14	
3	J. 12	"	J. 12 J. 15 J. 20	..	..	..	Very giddy and staggering before E.C.T.
4	J. 15	"	..	J. 15	..	J. 25	Giddy.
5	J. 14	"	..	J. 14	..	J. 20	
6	J. 18	"	..	..	..	J. 18	
7	J. 12	"	..	..	..	J. 12	
8	J. 18	"	..	..	..	J. 18	
9	J. 12	"	..	..	..	J. 12	
10	J. 15	"	J. 15	..	..	J. 20	Giddy.

TREATMENT 2.

No. of case.	Thresh- hold E.C.T.	Myanesin dosage.	Type of response.				Remarks.
			○	+	□	⊕	
11	J. 12	4 gm. p.o. $\frac{1}{2}$ hour before treatment.	J. 12	..	..	..	Drowsy, giddy, staggering before E.C.T. Unable to walk unaided. Lowered muscular tonus. No impairment of voluntary movement.
			J. 15	..	J. 20	..	
12	J. 10	ditto	..	..	..	J. 10	Hardly affected.
13	J. 8	"	J. 8	..	..	..	Drowsy, giddy, staggering before E.C.T. Unable to walk unaided. Lowered muscular tonus. No impairment of voluntary movement.
			J. 14	..	..	..	
14	J. 15	"	J. 15	J. 18	..	J. 25	ditto.
15	J. 10	"	J. 10	..	..	..	"
			J. 20	..	..	..	
16	J. 14	"	J. 14	..	..	..	"
			J. 20	..	..	..	
			J. 30	..	..	..	
17	J. 12	"	J. 12	..	..	J. 25	Not so severely affected.
18	J. 12	"	J. 12	..	..	..	Drowsy, giddy, staggering before E.C.T. Unable to walk unaided. Lowered muscular tonus. No impairment of voluntary movement. Extremities not involved.
			J. 15	..	..	..	
			J. 20	J. 25	..	..	
19	J. 19	"	J. 15	..	..	..	"
			J. 20	J. 25	..	..	
20	J. 20	"	J. 20	..	..	..	Not quite so staggering as previous ones.
			J. 25	..	..	J. 35	

TREATMENT 3.

No. of case.	Thresh- hold E.C.T.	Myanesin dosage.	Type of response.				Remarks.
			○	+	□	⊕	
31	J. 14	1 gm. i.v. 2 min. before treatment.	J. 14	J. 20	J. 30	..	
32	J. 18	ditto	J. 18	..	..	..	
			J. 25	..	..	..	
			J. 35	..	..	..	
33	J. 15	"	J. 15	..	..	..	
			J. 20	..	..	..	
			J. 30	..	..	..	
34	J. 12	"	J. 12	..	..	..	
			J. 20	..	..	..	
35	J. 12	"	J. 12	..	..	..	
			J. 15	J. 20	..	..	
36	J. 12	"	J. 12	J. 15	J. 20	..	
37	J. 12	"	J. 12	..	..	..	
			J. 15	..	..	J. 20	No change in pattern of fit.
38	J. 15	"	J. 15	..	..	..	
			J. 18	J. 20	..	..	
39	J. 10	"	J. 10	..	..	J. 25	Very short tonic phase.
			J. 15	..	..	..	
40	J. 10	"	J. 10	..	..	J. 20	No change in pattern of fit.
			J. 15	..	..	..	

TREATMENT 4.

No. of case.	Thresh- hold Phrena- zol.	Myanessin dosage.	Type of response.				Remarks.
			⊖	+	□	⊕	
21	. 7 c.c. .	1 gm. i.v. 2 min. before treatment.	..	..	..	7 c.c. .	Tonic phase slow in develop- ing.
22	. 7 c.c. .	ditto	..	..	..	7 c.c.	
23	. 6 c.c. .	"	..	..	6 c.c.		
24	. 4 c.c. .	"	..	..	..	4 c.c. .	
25	. 6 c.c. .	"	..	..	6 c.c.	.. 8 c.c. .	
26	. 6 c.c. .	"	..	..	..	6 c.c. .	Tonic phase slow in develop- ing and of short duration.
27	. 8 c.c. .	"	..	..	..	8 c.c. .	Sudden response with tonic phase.
28	. 5 c.c. .	"	..	..	5 c.c.	7 c.c.	
29	. 4 c.c. .	"	..	..	4 c.c.		
30	. 4 c.c. .	"	..	..	4 c.c.		

STATISTICAL EVALUATION.

Where no convulsion occurred, the convulsive threshold had been taken as one joule (or 1 c.c. of Leptazol) above the highest value administered without inducing a convulsion. In the circumstances this procedure underestimates or minimizes the significance of differences to an extent that cannot be determined.

I.

Treatments 2 and 3 differ very significantly (beyond 1 per cent. level) from treatment 1, but not at all from each other.

The mean raising of the convulsive threshold, adjusted for regression of treated on untreated threshold (and making the threshold assumption noted above), was as follows :

Treatment 1	1.99 joules.
Treatment 2	11.84 ..
Treatment 3	12.16 ..

The *F*-ratio for the differences between treatments (obtained by analysis of covariance) was 13.60, degrees of freedom 2 by 26, significant well beyond 1 per cent. level. The 95 per cent. semi-interval is 2.79, so that it is quite clear by fiducial limits that treatments 2 and 3 belong to a different universe from 1, but probably themselves belong to the same universe.

II.

The raising of threshold in treatment 1 is statistically significant beyond the 5 per cent. level (*t*-ratio equals 2.307 for 9 degrees of freedom). Treatments 2 and 3 obviously do not require examination in this respect.

III.

In treatment 4 the raising of threshold is statistically significant beyond the 5 per cent. level (*t* equals 2.875 for 9 degrees of freedom).

IV.

It is only possible to compare treatment 4 with the others by a contingency technique. If one compares the number who failed to show any response at their untreated threshold in treatment 3 with those who failed to do so in treatment 4, the figures are 10 out of 10 in treatment 3, and 0 out of 10 in treatment 4. These figures are clearly highly significant.

(2) *Effect of Myanesin in Some Psychiatric Syndromes.*

Although the present study was originally mainly concerned with the investigation of epileptic thresholds, certain effects of Myanesin on some psychiatric syndromes could be studied at the same time.

Schlau and Unna (1949) have already reported on beneficial effects of Myanesin by mouth on anxiety and the effects of drug addiction and alcoholism. This can be confirmed by our observations. After 2-3 weeks of continuous treatment with Myanesin 1 gm. *t.d.s.*, the beneficial effect on anxiety neuroses and psychoses often subsided, which also coincides with the findings of Schlau and Unna. The effect of higher doses is still under investigation. A patient with marked startle reactions, who, by any slight noise or surprise, developed great agitation, improved dramatically after Myanesin 1 gm. *t.d.s.* The tremor in some alcoholics in a delirium tremens improved markedly within a few minutes of the intravenous injection of Myanesin 1 gm. After the injection they could eat and move a cup to their mouths unaided, which had previously been quite impossible. One of these patients had marked tactile and visual hallucinations, seeing and feeling insects crawling over him, and behaving in the well-known way seen in D.T. After the injection he had lost these hallucinations.

A number of patients exhibited a much more marked euphoria following the combination of Myanesin and convulsive therapy than is usually seen after convulsive therapy alone. This and other considerations induced us to try a combination of Myanesin, not only with convulsive therapy, but also with prolonged sleep induced by sodium amytal and paraldehyde in some cases that had not responded to previous treatment, or others well known not to respond to such treatment, especially cases with marked obsessional manifestations, tension states or some schizophrenic reactions. Only investigations on a larger scale can show whether any beneficial results can be achieved with this combination, and in which sort of case. No consistent changes have so far been observed in schizophrenics or obsessionals, except a relief of anxiety, tension or agitation.

The effect of Myanesin on the incidence of fits or their equivalents in epilepsy is still under investigation.

DISCUSSION AND COMMENTS.

For the understanding of the possible mechanisms of Myanesin action it is necessary to refer to some of its pharmacological properties. Berger (1947, 1949) found that Myanesin in doses of 10-40 mgm./kgm. had no effect on neuromuscular junctions or the conductivity of peripheral nerves. Following 500

mgm./kgm., however, there is no response to indirect stimulation. Henneman, Kaplan and Unna (1949), in their study on the effect of Myanesin on motor systems, based on Magoun and Rhines' (1947) work on spasticity, conclude that Myanesin "decreases or abolishes facilitation and inhibition reaching anterior horn cells from all levels of the C.N.S." They believe that the site of action of Myanesin is probably the internuncial cell because short monosynaptic circuits remain unaffected, except (according to Birger R. Kaade, 1950) in excessive doses. The latter author also states that multisynaptic pathways are particularly vulnerable, and that such pathways are probably involved in conditions like spasticity, rigidity, choreatic or athetotic movements, *petit mal* and central pain, which are all known to respond favourably to Myanesin. Gammon and Churchill (1949), following clinical investigations, suggest that Myanesin prevents discharges arising out of subcortical nuclei; they even say that the action is differentially selective for the cluster of subcortical nuclei (basal ganglia, thalamus and brain stem). This is again an area particularly rich in multisynaptic mechanisms and, therefore, highly sensitive to the drug. This sensitivity appears to increase gradually from the periphery to subcortical structures.

B. R. Kaade (1950) observed that Myanesin in doses of 30-40 mgm./kgm. had no appreciable effect on spontaneous brain potentials of the motor cortex, sensory cortex, suppressor and cingular cortex, nucleus caudatus, thalamus and bulbar reticular formation. Higher doses, however, depressed all the different cortical and subcortical structures. Excessive after-discharges following electrical stimulation, which easily spread over the whole cortex, could be reduced or abolished by 15-40 mgm./kgm. of Myanesin (B. R. Kaade, 1950). It is most likely that Myanesin reduces or abolishes the spread of the irritative lesion produced by E.C.T., thus leading to a rise of the threshold. B. R. Kaade also observed similar effects on cortical after-discharges following other afferent impulses. The most probable explanation for the less marked threshold-raising effect on Phrenazol fits is the antagonistic effect of Phrenazol on Myanesin, similar to the marked antagonistic action between strychnine and Myanesin. Torda and Wolff (1947) noticed that cholinesterase activity is depressed by strychnine and Phrenazol which effect will probably also render Myanesin activity less apparent.

It seems probable that the euphorizing effect and the influence on hallucinosis are also the result of cortical depressant action. A depressant effect on cortical and subcortical structures might lead to improvement of anxiety and tension. If an abnormal thalamic or hypothalamic activity should prove to be responsible for certain akinetic or stuporous states (Cairns, Oldfield, Pennybacker, Whiteridge, 1941; Hunter and Jasper, 1949), an effect on schizophrenic stuporose states could possibly be expected by such action. The effect of drugs is also accompanied by changes in bioelectric potentials.

The stimulating effect of certain substances, e.g. strychnine, is enhanced by an increase in cathelectrotonus, and reduced by anelectrotonus. Their effect might actually result from a change in the electrotonus and its influence on the propagation of nervous impulses. Similarly, Birger R. Kaade (1950) suggests that Myanesin might lead to an increase in anelectrotonus,

and that this effect is most apparent in long circuits and multisynaptic systems. It is probable that drugs like Myanesin will open up new possibilities in the treatment of nervous and mental disorders, especially if longer acting preparations can be developed.

SUMMARY.

1. Myanesin is found to raise the threshold for E.C.T. and Leptazol.
2. The effect is less marked on Leptazol thresholds.
3. Some effects on psychiatric syndromes are reported.
4. The mechanisms of these phenomena and their possible significance are discussed.

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MIGRAINE AND PSYCHOPATHIC BEHAVIOUR.

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THE man, B. T—, who is the subject of this short paper, is an ex-service man aged 32. On 4 October, 1949, he was charged at Quarter Sessions on 20 counts of stealing from the offertory boxes of churches. He was put on probation on condition that he entered this hospital. Previously he had committed 68 similar offences, and has been in prison for 8 months. In 1939 he suffered a head injury and since then has had attacks of headache, vomiting and visual disturbance from time to time.

The report of the probation officer gives concise details of his family and previous history.

Family History.—Father died in 1927 of V.D.H., and is said to have suffered from neurasthenia, aged 47 at death.

Mother died 1940, cause of death, dropsy.

Six brothers living, all except B. T— married and are said to be normal people. Most of this information is gathered from the eldest brother, aged 41, who lives with his wife and small family. This man seems a fairly reliable type of person, and the home reasonably clean and comfortable, although in a rather poor street.

Three other children died in infancy; one of convulsions; one of pneumonia, and one at the age of 7, from meningitis. Nothing is known of any mental illness in the family.

History.—Nothing unusual is recollected, regarding B. T—'s childhood, except that he was badly scalded at the age of 3 or 4. There was no particular family friction. He did not mix much with other boys and had no real pals. Owing to the death of father, eldest brother took charge of family affairs from 1927–32. As far as is known he got on moderately well at school. He did attend a church Sunday school during his boyhood, and it is believed that he was confirmed after joining the Army. On leaving school worked for a year as errand boy for a firm of grocers, then for 18 months with another firm, then unemployed for one year—no reason known for this, except general trade depression—then, at 17½, enlisted in Sherwood Foresters and served in the West Indies and Palestine. Early in his army career—19.i.35—he appeared at Alfreton Magistrates' Court charged with stealing a bottle of mineral water and being absent without leave, was returned to his unit under military escort. On the outbreak of war he was posted to the South Staffs. Regiment, and served in North Africa, Sicily, Italy and Austria, rising to the rank of sergeant, and was demobilized about the end of 1945 with a good character. He was wounded in the shoulder and was awarded the Military Medal for distinguished conduct. It is thought that he also received a head injury while engaged in quelling riots abroad, during peacetime service.

After expiry of his release he, in April, 1946, obtained employment as a temporary Civil Service clerk at the Ordnance Depot, Boughton, Notts, and remained there until 10.ix.48, at a weekly wage of £5 12s. 0d. During this time it is believed that he sat for an examination with a view to becoming a permanent clerk, but failed. He made no complaints about his work there and said it was quite easy. He left there during the time that he was on bail awaiting trial at Notts Quarter Sessions. A certificate from the Ordnance Depot indicated that he left through his own resignation and that he was a capable clerk for routine work, and was considered satisfactory.

On 11.x.48, charged at Notts Quarter Sessions with 6 charges of stealing from offertory boxes in churches, and asked for 62 similar offences to be taken into consideration.

Sentence : 12 months in prison.

Bail through Magistrates' Court on 6.ix.48. While on bail committed a further 20 offences and was again arrested, and on 29.ix.48 committed to custody.

From leaving Army, until arrested for these offences, lived with eldest brother, and during this time nervous mannerisms were noted, particularly whilst engrossed in reading, fingering a lock of his hair. He was usually somewhat morose and uncommunicative, spending much time reading "anything from comics to Shakespeare," and went hours at a time without speaking. He did, on occasions, mention places that he had visited during his Army service, but never spoke about his battle experiences. He was known to drink but was never seen drunk. Was not usually out late at nights and altogether caused no suspicions at the time when he was committing the offences in Notts. He always kept to himself, except that towards the end of his stay he went out with his brother occasionally. During this time, about the end of 1946, he was off work 3 months owing to chest trouble, and was examined and found to be free from tuberculosis. He did not seem to desire his brother to go to Quarter Sessions and did not communicate with him from prison, and has not, since released from prison, returned to his brother's house.

The brother's opinion as to the cause of B. T—'s trouble is that it can only be attributed to something arising from his military service, and he says that if and when his brother desires to return, he will provide a home there for him.

I have made enquiries from his own doctor and find that towards the end of 1946 B. T— went to him suffering from nervous and general debility, and was altogether rather run down. He had lost some weight and had a persistent cough. An X-ray examination of his chest was made and no sign of disease was found except some trace of bronchitis. The doctor said that B. T— seemed quite a decent young man and gave no indication of any abnormal state of mind, except that the doctor particularly noticed T—'s quiet reserved manner. The doctor could give no information regarding family medical history and was not aware of any source from which this could now be found, but as far as he knows there have not been mental troubles in the family. He could not enlighten me regarding the father's neurasthenia.

The only comments I would like to make on this excellent anamnesis are the following : he was a temporary clerk, lacked security, and in consequence was anxious to become a permanent official. On this account he was studying at evening classes. He did not find the work easy and found it very different from the Army routine. As a result of his illness, near the end of 1946, he was unable to sit for his examination. Later he sat for another examination for which he had not been appropriately prepared, and failed. Regarding his illness at the end of 1946, his doctor wrote and told me that he was suffering from headaches, "blackouts," cough, and general debility. He was off work for about four months. His doctor suspected that his debility might be due to tuberculosis ; according to B. T—, the reason why he went to the doctor was because of these "blackout attacks."

It should be pointed out that, though he was in charge of the accountancy side of the Ordnance Depot, there was no evidence that he took money when at work, and he was regarded as a reliable official. Again, when he first started raiding offertory boxes he was on full sick pay and not in urgent need of money.

I now give his own account of the first time he opened an offertory box.

At the latter end of March, 1947, whilst I was still under the care of my own doctor, I went for a walk out into the country, I passed through a village about

five miles from my home. I passed by the village church that was about half a mile from the village. I was feeling tired, so I turned back and entered the church. This was the first church that I had entered voluntarily for quite a considerable time.

After sitting down for a while I explored the church; it is very old, of the pre-reformation period. All the pews are closed in, of the box type, very badly worm-eaten. The font is old stone, approximate date, 1600-1700.

As I was coming out I saw a large wooden box with a slot on the top standing on a table. Taking this box to be for the collection of money, I put some coppers into it and heard them chink against the money already in the box. I stood and looked at the box, and picked it up, and I felt an urge to open it. I pressed on the lid, this must have been very loose, as the lid flew open, scattering the money on the floor.

I picked up the money and put it on to the table. I also emptied the contents of the box on to the table. I then counted the money and arranged it on the table in piles as I did the union fees at work. I forget the exact amount, but I think it was in the region of ten shillings.

After counting the money I returned it to the box and attempted to fasten it. Finding this impossible, I put the box back on to the table and walked out of the church. I removed nothing from the church, neither did I take any money.

After this I seemed to get an urge to enter churches, and once in the church I found myself making straight for the offertory boxes.

Questioned further, he said that he had become interested in the architecture of churches, he also found the church restful and secluded for meditation when worried, and he felt an urge to enter them. Once in the church there was an urge to "force" the box, using a blunt instrument. For a long time he used a chisel which he had found in a churchyard. After the first conviction he used an iron bolt, a key, or whatever he could find. On questioning he admitted that this "rape of the Mother Church" was associated with sexual excitement and erection, but he denied orgasm.

He was at pains to convince me that taking the money was not of primary importance. At first he did not take the money at all. Later, he took it from one box and put some of the money in another box. At the conscious level he was interested to see how much money the congregation put into the box. Were they paying enough for the services rendered?

He explained that his interest in churches was first aroused during the battle of Cassino.

Five days before the Battle of Cassino I was informed by Commanding Officer that I would be needed for Route control in the forward areas.

At midnight on the 14 May, Lt. Gethin, myself and 12 men, went forward to the Infantry lying on the banks of the Rapido, and did an immediate reconnaissance, as we had been informed that zero hour was imminent, actually it was three o'clock in the morning of the 16th. We had four routes to plan and control, and keep in order, Red, Amber, Blue, and White. As the Infantry moved forward these routes had to extend with them. It was therefore necessary to know what the land was like on the enemy side, a reconnaissance of enemy ground was decided on. Lt. Gethin wished to go, but as I pointed out, his place was with his command; I went. The reconnaissance was successful and all our plans were made for zero. Radio connection made (not to be used till after zero), telephone cobbles laid and everything was ready. Our Control Headquarters at this time was in a dug-out, and our men detailed to positions back along the routes.

Zero hour opened on the 16th with four hours' artillery barrage. Unfortunately, some of the guns fired short, we lost a man injured. On the 16th and 17th the battle raged, and we were not making any headway. Our little Headquarters was busy bringing up divisional rescue ammunition, as detailed by Divisional Head-

quarters, and routeing back wounded, keeping the routes clear and making sure that the armoured fighting vehicles did not come up before the bridging equipment, etc.; and that the units taking part in the battle did not send up luxury items (such as N.A.A.F.I. supplies, Sgt.-Major's bedding, officer's mess kit, etc.). Roughly speaking, our job was this. In the back areas we had laid out three large assembly areas. Into these areas all vehicles and men assembled. Armoured fighting vehicles, ambulances, bridging equipment, rescue Infantry, reserve ammunition, rations, etc. In each of these areas we had a Corporal and one man. Their job was to group everything under serial numbers, i.e. we will say that reserves for the "Kents" arrive, armoured fighting vehicles of 13th Brigade, and Division reserve ammunition, the Corporal would give each party a serial number. This number would be forwarded to our Headquarters, and we would send for the party by serial number when required. This method ensured that the routes were clear, and that when the enemy finally broke and bridging equipment was called for, we could get it there immediately, and not, as in former battles, where bridging equipment was called for and found to be held up behind armoured fighting vehicles which could not go into battle till the bridges were up. (Incidentally this was the first time battle control, as it was called afterwards, was tried out; Divisional Headquarters told us what they wanted, but Lt. Gethin and myself worked out the control plans.) On the morning of the 18th the enemy broke, and the Infantry went forward, bridging equipment was called for, bridges erected, the armoured fighting vehicles went over and into battle, and began their advance on Rome. Lt. Gethin was in front, I took control and moved Headquarters into Cassino itself. I had not slept since the evening of the 16th, and it turns out that I did not get any sleep until I was relieved on the morning of the 22nd, and, after Lt. Gethin left, I had no food except biscuits and water. My men were O.K., they were in pairs, and up to now they could sleep in turns, and eat in turns, I, unfortunately, was on my own, and with the radio and phones I had not time to light a cigarette. Everything, even the calls of nature, was carried out whilst working. On moving into Cassino, I jettisoned everything but the telephones and radio, a packet of biscuits, water bath, revolver and serial lists. In Cassino I ran into some heavy mortar fire, so I placed my Headquarters in a ruined church. The church was just inside Cassino, very small and with a small churchyard round it, it was very badly shelled; inside it was ruined, just a mess of tapestries, altar ornaments, etc. I put the radio and phones up in one of the confessional boxes; these boxes, which were placed against one wall, did not appear to be much damaged. The only thing that strikes about this church is the calmness after the mortaring and sniping outside. Whilst I was at Cassino I had a rough time, but I was relieved on the morning of the 22nd and went back. I was awarded the Military Medal. I am sorry my description of being at Cassino is so vague, but I cannot remember much about it.

His story of the battle is given in full because it is important to realize that it must have been a period of great stress and endurance. As against this the church stood out as the one haven of refuge. Questioned about his subsequent interest in churches, until the incident already noted, he said he had not been in a church since Cassino. Prior to Cassino he had not been in church since boyhood, except for church parades. It came out that he had had too much church and religion in childhood, and had rather avoided them since he left home.

The position so far is that he had too much church as a boy. When he left home and joined the Army at 17 he tended to avoid the church. The church at Cassino was a place of refuge, it was the Mother Church. When he had his breakdown in 1946 he again sought refuge with his mother, the Mother Church—incidentally it should be noted that the first rape of an offertory box took place in the church in the yard of which his mother had been buried.

Clearly there was ambivalence towards the mother and the church. His earliest recollections helped to explain their nature:

Before the Age of 6, When He Left the Infant Class.

1. { Having measles and being in bed for a time.
Hearing the boys playing in the street below.
A picture at the foot of my bed, with shepherd and sheep, etc.
2. A chocolate Easter egg with cotton-wool chickens inside.
3. Starting school, being taken there by mother, feeling silly as the teacher led me to each child in the class.
4. After being absent from school, the teacher patiently teaching me the letters of the alphabet that I had missed.
5. Walking to school, on my own down the street, looking back and seeing my mother standing at the gate, with a shawl over her head watching me.
6. My first fight at school, the crowd of boys forming a ring, shouting and pushing, feeling frightened, getting punched on the ear, and losing my temper.
7. Singing some nursery rhyme, at a Christmas concert, forgetting it half-way through and running from the stage.
8. Getting something into my eye, going to the doctor to have it removed, staring into a glaring white light.
9. In hospital for operation on tonsils, mother leaving me, and a nurse taking me into a ward. Being surprised at the number of beds and the whiteness of everything.
- Feeling very frightened when I was led into the operating theatre, trying to get off the table, feeling very sick and pains in my throat afterwards. Being pleased that father has come with mother to take me home.
10. My father brings home a large tin of paint. My brothers and myself painting kitchen, all got a good licking.
11. Leaving the infants' classes for second grade school.

Before the Age of 10, When His Father Died.

12. Fighting with someone who had laughed at my efforts at football.
13. Playing truant with my friend and having the bad luck to run into my father.
14. Smashing the back window of my friend's door whilst playing cricket on his back garden.
15. After listening to a lecture on the "Incubation of Crocodile Eggs," my friend and I removing the eggs from my father's chicken sheds and burying them in the manure heap. Father going down to the sheds, coming back and collecting my brothers and myself together and asking us each in turn what we had done with the eggs; owning up, a good hiding and bed.
16. One of my brothers and myself coming through Coxmoor Woods, with our pockets filled with pheasant eggs, being chased by a gamekeeper, falling, smashing all the eggs, my brother helping me up and both of us being caught, taken home to father, and the gamekeeper demanding the usual tanning, which we got.
17. Climbing a ruined tower in the woods, getting stuck at the top, and father's fetching me down.
18. Climbing on to roof through bedroom window, and stuffing rags into the chimneys of house next door.
19. Moving to high grade school.
20. Falling through ice into the pond, the long wait before I was fetched out.
21. Taking the alarm clock to pieces, father stopping my spending money till it was paid for.
22. Going to Edwinstow, to see the Major Oak, taking the wrong turning in the forest and ending up at the place called Allerton, deciding to walk home, arriving home in the early hours, to find father and the police and half the neighbours out looking for me. Mother making a fuss of me, sending me to bed before father came home.
23. A teacher making remarks about my impediment of speech; fighting two boys outside the school who followed the teacher's lead; arriving home with a cut head, a tooth missing and my coat torn. Father giving me a hiding, but later on asking me what the trouble was. Myself explaining, and, next morning, father taking me to school to interview the teacher, the same day father came home with boxing gloves and from then on my brothers and I received boxing lessons from father. Also I received lessons in the evenings from the vicar to try and improve my speech.

24. A holiday on a farm in Yorkshire, being taught how to ride by the son of the farmer. Upsetting a can of cream I was carrying to the kitchen.

25. Standing on a chair swatting flies, and falling through the window and cutting my hand.

26. The death of my father, the house upset, my mother crying and ill through shock (I cannot remember feeling any sorrow, only excitement), The funeral, the slight feeling of importance. Seeing the soil falling on the coffin, and the sudden shock as I realized that I should never see father again.

Aged 10-13.

27. After father died, money in the family became scarce and spending money for us boys less. We did not, of course, realize what a struggle mother was having, and the following paragraph I have bitterly regretted.

28. Mother used to keep a cocoa tin on the shelf with coppers in it for the gas meter, and I remember that on three occasions I took coppers from this tin to buy sweets.

29. Helping a local coal merchant after school to deliver coal, the pride of giving mother the two shillings a week I earned, and being pleased when mother gave me sixpence back, sixpence being a lot of money to me then.

30. Playing truant from school, walking out into the country, taking apples from a farmer's orchard, eating too many and being very sick.

31. Deciding to run away from home, stayed away all night, got fed up and came back next morning to find that mother had been up all night looking for me.

Mother crying, myself feeling a sudden sympathy and love for mother that I cannot remember before. Crying and promising that I would not do it again.

32. Leaving school, standing at the gate and looking back at the school and thinking that no more should I go there, discovering that I felt sorry.

33. A few days later starting work at a wireless shop.

These recollections reveal a high-spirited boy, always ready to play truant, steal birds' eggs, climb towers or roofs, and to fight if necessary. It is the same man who, as a soldier, is dared to steal a mineral bottle and gets court-martialled. It is the same man who, at ———, was caught out of bounds chasing rabbits, lost his parole and other privileges.

Paragraph (23) is significant, since it shows how sensitive he has always been about the impediment in his speech. It is very slight and only over certain words. But for him it is a very big thing, and it has made him rather introverted and hypersensitive. He does not mix easily and likes to be alone, reading.

His father would appear to have been a stern man, not backward with a beating, but just and understanding. Also when his father was alive there was adequate money, for besides a pension, there was a small business.

After the death of his father, his own description of the changed circumstances is clearly made out. What he does not mention is that his mother was a very religious woman. It was her habit to consult the vicar on all her troubles. She was a regular churchgoer and insisted on her children attending church and Sunday school regularly. It was also her habit, when worried, to go to the church for quiet meditation. B. T— resented the amount of time he had to spend at church and Sunday school. Still more did he resent the sixpence his mother always put in the offertory box when she went to the church, and the pennies she gave her children for the same purpose. Out of her restricted means he thought that the church swallowed up far too large a proportion. Sometimes he and his brother played truant and spent their

pennies. As noted, after he left home he avoided the church as far as possible until Cassino.

It is clear there was ambivalence to the mother at an early age, and this soon extended to, or associated with, the church. His mother died when he was abroad in 1940. He was deeply affected by this news, and has had feelings of remorse about his treatment of her. He feels that he had not appreciated her affection and had not understood her difficulties. Further, he feels it was wrong of him to desert her and to enlist in the Army.

The next important incident was the head injury in 1939. Up to this time he had been a successful soldier and had risen to the rank of sergeant. Again, the description of what happened in Palestine is given in his own words.

In the early part of 1939 my regiment was serving in Palestine (1st Battalion, the Sherwood Foresters).

For riot duties the Regiment was formed into two units. These units were known as Haifa Column "A," composed of 1st line fighting troops, and Haifa Column "B," cooks and batmen, etc. I belonged to the first mentioned. Late one night Column "A" was called out (I cannot remember the exact date, but I believe it to be either March or February), and we proceeded to a village a few miles from Parafond, where we had been informed that a section of the Arab Rebel Army was resting. On arrival there we carried out the usual procedure, that is, we posted stop parties on the high lands around the village, and sent in a riot squad, I was a member of this squad.

The village was reached without trouble and a few people taken prisoners, the search then moved out of the village into the orange groves, where we met trouble. We were moving in extended section order with Lt. Rivett-Carnac and Lt. Sadbury in the centre.

The enemy, who had taken up position at the far end of the grove, opened fire, killing Lt. Rivett-Carnac, and wounding a few more (Lt. Sadbury received the M.C. for this action).

Myself and section took cover and commenced to work round the enemy's flank, at the same time a Vickers from the nearest stop party opened fire, this fire was successful, as when my section arrived in position for attack everything appeared quiet. So after reconnaissance we went in, a few dead and wounded Arabs were lying about, otherwise everything was deserted.

The position the enemy had occupied was composed of a number of caves and two huts. We proceeded to search these, myself and two others entered one of the huts and were looking round when there was an explosion, something struck me at the back of the head and I was knocked unconscious. On recovering, I found I had a large swelling and a small cut at the back of the head. The cut was bleeding quite a lot. Also I found that my eyes were queer, for a time I could not see, and then I was seeing double (I remember wondering whether I had been knocked cross-eyed). I sat down for a while and tried to sort out what had happened. I could not think very clearly. Then my eyes appeared normal, the only thing wrong, as far as I knew, was that when I reached for my rifle I kept missing it. Also about this time I was very sick with vomiting, but this cleared up and, except for a headache, everything appeared alright.

The others, who had come up on hearing the explosion, bandaged my head, and assisted me with the two other men who had entered the hut with me. After the search had been completed, the unit returned to barracks, where I reported sick. The M.O. examined my head and dressed it, and told me to report sick the next morning. I then went for a meal, which I found impossible as everything I swallowed was vomited back. My head was still paining me severely. The next morning I reported sick, and the swelling had gone down a lot, but for a week or more afterwards I had pains in the head, at the back behind the left ear, and in front above the eyes, also after every meal I was vomiting. This eventually cleared up and, except for headaches, and (from what the people in my barrack room told me) talking in my sleep and walking in my sleep, I appeared alright, also I found myself getting absent-minded to a certain extent.

About three or four months after the initial accident I had a very strange experience, I was reading a book and I felt a sudden sharp pain in the head, it appeared to begin behind my left ear and travelled to above my eyes, and then I got the feeling that everything was happening very fast. My thoughts appeared to be revolving swiftly round and round on the same subject.

I then noticed a small speck in front of my eyes, this got larger until I could see nothing but a speckled mist, blotting out all sight. This mist appeared to be formed of brightly-coloured specks, which were dancing up and down. The edges of the mist were coloured and jagged like lightning flashes. This lasted, as far as I could judge, about one hour. During this time I was unconscious of anything happening around me, and my thoughts were still repeating themselves. This cleared and left me with a bad headache, and after meals that day I vomited. I reported sick the next morning, the M.O. told me it was a slight attack of sand-fly fever, but until I returned home I was getting these attacks. Sometimes two or three times a week. Sometimes I would be alright for about a month. On coming home, January, 1940, I was very pleased to find these attacks had finished. The next attack of a similar nature I experienced was after the battle of Mefi-El-Bab, in Africa with the First Army, and there were no more till after the Battle of Cassino in Italy. Since then I have had them frequently till I came to Laninval, when I had one attack on 17 October in the town of Bodmin.

In all these attacks vomiting, severe headaches and a certain amount of loss of memory have followed.

It is clear that prior to 1939 this man had shown no evidence of neurosis. In that year, while on active service, there was an explosion in a hut and he was struck on the head; actually in the left occipital area. He was unconscious for a time, and when he returned to consciousness he found a swelling on the back of the head and a small cut. He also had a headache, vomited, could not focus properly and could not think clearly. For the next week he had head pains, both back and front; vomited after every meal; talked and walked in his sleep and found he was absent-minded. He reported to his doctor and the wound was dressed.

Three to four months later he had the first of his "attacks." I need not go over his own description again. He continued to have these "attacks" up to two to three times a week while he remained in Palestine. In 1940 he returned to England and had no further "attacks." He had his next "attack" after the battle of Mefi-El-Bab (1943) and not again until after the battle of Cassino (1944). From then onwards he continued to have "attacks." Since he has been in this hospital he has only had one, and on this occasion, also, it was brought on by emotional stress. It should first be explained that one of his main fears is that the other patients should know that he has been in prison. Two other patients had arranged to go to a neighbouring town for tea with the relations of one of them. B. T.—had thought he was one of the party, but walking towards the bus-stop he learnt this was not so. He did not return to the hospital but went off on his own. While in Bodmin he had an "attack." He told me afterwards that he had immediately jumped to the conclusion that the others knew that he had been in prison and that he was being ostracized. His feelings of insecurity and worry when he came back to civilian life have already been noted as a cause of his nervous symptoms. While in prison, and after, his "blackouts" were frequent. His own account of these periods, which I give below, leave little doubt that acute emotional disturbance was the causal factor.

I arrived at the prison in the afternoon of 11 October, 1949, from Notts Sessions. I was admitted into the reception block where I was locked in a cell for a time. After a while a meal was brought to me consisting of part of a loaf and a piece of margarine. I was left in the cell until six o'clock (I remember hearing a clock strike somewhere). I was then taken for a bath and Medical Inspection and a change of clothing (prison clothing). After medical inspection (the normal Army F.F.I.) a pillow case filled with towel, soap, sheets, etc. was handed to me, and I was hurried up a flight of iron stairs to a cell; this cell I stayed in during the whole of my stay. I was ordered inside and the door banged shut and locked. This door was not opened again until 07.30 hrs. the next morning. The cell was the normal type, window very high up the wall so that nothing could be seen outside. I didn't sleep that night, and lay counting the times the peep lob in the door was opened.

The next morning the door was banged and someone called out "Get out of it and make your bed up." At 07.30 hrs. the door was unlocked and I was ordered to "Step out." This, I found, meant pour down the lavatories the waste that had accumulated during the night. This period, by the way, was a very dangerous time for the staff, as this was the only time during the day when prisoners were allowed to mix freely. I saw many fights during this time during my stay in prison.

After breakfast, consisting of porridge and tea, I was taken to the centre (this was the officers' part of the prison) and left standing in a passage until 10 o'clock, when I was interviewed by the Governor of the Prison, Chaplain and Labour Selection Board in turn. These interviews took up the whole morning. At 12 o'clock I was taken back to my cell for dinner. At 14.50 hrs. I started work sewing old mail bags. I continued this work the whole of my stay.

A normal day composed :

Reveille 06.30 hrs. ; "Step Out" 07.30 hrs. ; Breakfast 08.00 hrs. ; Parole for Labour 09.30 hrs. ; Dinner 12.00 hrs. ; Parole for Labour 14.30 hrs. ; Tea and Lock up 17.00 hrs. ; Lights out 20.00 hrs. Every day was exactly the same, with the exception of Sunday, when it was church in the morning and in the afternoon. At 17.00 hrs. every day a new, unsewn mail bag was placed in the cell, this had to be sewn complete by Labour Parole the next morning. My greatest troubles at this prison were being unable to sleep properly, headaches, blistered fingers, the long hours of being locked in the cell ; a constant supervision, the poor food (which gave me boils on the back of the neck) and the lack of cigarettes.

I never reported sick there, neither did I get into trouble, I also made no friends.

On 12 November I was transferred to —, where I went through the same number of interviews, but this time I was employed sewing the new mail bags.

The routine at — was very much the same as at my former prison, with the exception that the cells were unlocked at 17.00 hrs. and not locked again until 21.00 hrs., and after tea we were allowed to associate with the other prisoners.

On Saturday and Sunday afternoons football and cricket were played ; everyone was allowed to play or watch.

The biggest trouble here was again the cigarettes question. Many of the prisoners earned more money than the remainder, according to what type of work they were employed at. So, therefore, those on the higher scale of pay could afford cigarettes every week, whilst the others could only get them once a fortnight. This gave rise to a bad state of affairs, and erected what was termed the "Tobacco Barons." These "Barons" earning large money, bought every week cigarettes, tobacco and papers, and made very thin cigarettes which they sold to the lower scale of prisoners for a halfpenny each. These were normally sold on credit in the week, and on pay day the "Barons" collected the money owing to them. Of course, a lot of the prisoners would not pay, so, therefore, there were fights, stabbings, etc.

Another bad thing at — was sex offences. The place was termed a First-Offence Prison, and three parts of the prisoners were long-term prisoners, bank robbers, robbing with violence, murderers(— and many other well-known murderers were there) and sex crimes (mostly against boys).

The long-term prisoners (some had been there six or seven years) and the sex criminals created a very filthy state of affairs, and the young prisoner was pestered and preyed upon until he had to fight for himself or report the matter (when he reported the matter he was told to bring proof ; also he was called a "Squealer "

by the prisoners and beaten up). A sense of ordinary decency did not exist at —. My headaches, sleeplessness and boils were just as bad and I was feeling very depressed, and looking forward to Christmas when there should be a change in routine. At last Christmas came, and was not too bad, a concert, film show, two or three football matches and a whist drive. The food was good. After Christmas we settled down to the old routine. On 12 January, 1949, I was sent out to the open camp five miles away. Conditions were good, no doors locked, no walls, just like an Army camp and open-air work, felling trees, digging and ordinary farm work; it was hard work and long hours but it was better than —. The class of prisoners was better, all young prisoners doing short terms, I stayed there 17 weeks when, unfortunately, a fellow prisoner and myself were caught out of bounds chasing a rabbit.

I was sent back to —, where I carried on the same type of work as before until I was discharged on 11 June, 1949.

After leaving I was not feeling too well, and very unsure of my welcome at home, so I decided to try and find work somewhere else. I had about twenty-five shillings in cash. I walked to —, about twelve miles from —, and tried the Labour Exchange. They advised me to leave my Insurance Cards there and register for work. This was, of course, impossible, as I required lodgings and money, and who would give lodgings to an unemployed ex-prisoner?

I decided to make for Filey (Butlin's Holiday Camp); it took me three days to get there, sleeping in haystacks, and living on cups of tea and a couple of buns at the cafés I encountered—by this time I was badly in need of a shave, so I bought towel, soap and razor, price 6/11. At Filey they were sorry but their staff was complete, but they did give me three days' work cutting the lawns, for this they paid me forty-five shillings. After this I tried the hotels of Bridlington, Filey, Saltburn and Reslew, with no luck. I was not feeling too well, the lack of food, constant worry about the future, improper sleep (I was still sleeping in haystacks), the need to keep up appearances, I had to buy a shirt, this made a hole in my cash, altogether these were undermining my stamina. I still had headaches and black-outs. But I was determined on three things.

(1) To make a fresh start, (2) to avoid churches, (3) not to communicate with my people until I could show them that I was once again leading a clean and honest life. By this time I was into July, so I decided to go down country, I wished to avoid places where I might meet someone from my own district, so therefore I missed Hull, Cleethorpes and Skegness, and spent half of my cash getting by bus to Boston. It will not strike you as strange when I write that I remembered Boston because of the "Boston Stump," a world-famous church, and I also knew that Boston was a market town for South Lincoln, and hoped to get work on the farms. On arrival at Boston I was surprised to find the town and district appeared to be full of strangers. I soon discovered why, it was the strawberry season, all the strangers were pickers. I gave up my idea of a regular employment, and concentrated on strawberry picking. The pay was 1/9 an hour, we could work what hours we liked. I started off by finding a convenient haystack, and working from six o'clock in the morning till ten o'clock at night, allowing myself an hour for lunch. After a couple of days this was too much for me, so I was lucky to find digs in Boston for a few days, so I started at seven and finished at nine. My sole idea at this time was to amass as much cash as possible. For this reason I cut out breakfast and tea. I worked on this job for just over a fortnight and that was the end of the strawberry season. At the end of the season I had a total of just over seven pounds left. I went the round of the district for a regular job with no luck, so I decided to push on. I should here mention that at the farm where I worked I had to pass a church morning and night, it was about the fifth or sixth evening after I had started work that I went into the churchyard on my way back from work. After walking round the churchyard I tried the door and found it was open. I went inside and sat down, I made a habit of going in the church every evening, and in the end I broke open the offertory box.

I went by various buses to Cambridge and stayed there two days. My sole reason for going there was that I had never been there. From there I went to Oxford for the same reason.

My cash was going fast, so I decided to look for work, I eventually got to a place called Cirencester where I applied at the Labour Exchange for work. They asked me where I had been so I told them the truth. They told me they were sorry

but there were many men in Cirencester looking for work, who had not been to prison, but if I liked they would put my name down for work. I pushed on. (I am sorry everything is very vague just about this time, I know I worked at hay-making, and I know I entered many churches, but where I went between Cirencester until I arrived at Boscastle, in Cornwall, I am not sure.)

By the time I arrived at Boscastle I had given up all hope of obtaining work, and I was feeling very ill, and getting frequent blackouts. My chief concern was to live.

From Boscastle I wandered all over Cornwall, Tintagel, Bodmin, Truro, Camborne, St. Ives, Land's End, Penzance, etc., and finally I was arrested at Penryn.

To summarize, this man had an occipital head injury in 1939. Since then, when under emotional stress, he has had "blackout attacks" with head pains, vomiting, mental and visual disturbances. It should be added that when specifically questioned he described the head pain as confined to the left side.

X-ray of the skull was negative. Examined by a neurologist, there were no signs of organic neurological disturbance. The neurologist regarded his symptoms as an expression of his psychological disorder. The ophthalmic surgeon reported that the field of vision was within normal limits, with no evidence of scotoma. He inclined to the view that his attacks resembled migraine.

My own view is that the experience in 1939, which included concussion, set in action a reversible, psycho-physiological process, fairly typical of migraine. This reversible process is reactivated when the subject meets with emotional stress. Rich states that, of his series, only 14 cases of migraine were idiopathic. The other 49 were associated with intracranial haemorrhage. He goes on to say that many cases finally develop permanent visual field defect. Most authorities are agreed that the scotoma is due to vasoconstriction of the branches of the internal carotid and the subsequent headache to vasodilation. Von Storch describes a migraine personality. In childhood he is shy, obedient, neat and reliable. He is stubbornly inflexible in certain circumstances. As an adult he is a perfectionist, ambitious, inelastic, tense, resentful and repetitious. He is also efficient and has poise and social charm. This, except perhaps for obedience in childhood, could well apply to B. T.—. Storch also states that people suffering from migraine usually have some sexual maladjustment.

The relationship between the migraine-like attacks and the stealing from offertory boxes is less easy to be dogmatic about. It may be that the migraine has in some way, and to some extent, broken down the hegemony of the mind, allowing an unconscious complex to emerge and dominate consciousness from time to time. There is no evidence that the migraine attacks and the psychopathy were ever directly associated in time. That is, he never opened an offertory box during one of the "attacks." On the other hand there is evidence to suggest that when things were going badly for him and he lacked security, both symptoms became conspicuous, though the psychopathy only developed many years later. Again, when he was reasonably secure, during the years 1940-42 when he was in England and since he has been in this hospital, he was free of both symptoms.

Some might regard the attacks as sensory Jacksonian fits. It might even

be suggested that the psychopathy was a psychic equivalent. Keyes rightly points out the risks of such a diagnosis and the danger of its use by the unscrupulous in medico-legal cases.

B. T—, following treatment, has very fair insight. It would seem probable that, given reasonable economic and social security, he will make a satisfactory adjustment to peacetime conditions.

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THE FACTOR OF NUMBER IN INDIVIDUAL- AND GROUP-DYNAMICS.*

By JOHN RICKMAN, M.A., M.D.Cantab.

THE term "Group-Therapy" can have two meanings, and it is well to keep the distinctions clearly in mind. It can refer to the treatment of a number of *individuals* assembled for therapeutic sessions, or it can refer to a planned endeavour to discover (and so make accessible to the understanding, and thus control) the forces which operate in the participating *group*.

The first is primarily a therapy of *individuals* (group behaviour and its study being a secondary but important consideration); the second is primarily a therapy of a *group* (individual behaviour and its study being a secondary but important consideration). These two may blend.

The first is found in several forms which we can name according to where the dynamic emphasis is laid. One kind is based on general explanations of the nature of neurotic trouble; this may be called *didactic* group therapy. The physician may, however, be less concerned with explanation and more interested in giving comfort; this may be called *reassurance* group therapy. The comfort and companionship may be carried far, that is, the aim may be to produce such a degree of happiness in the group as to deserve the name *companionate* group therapy; or the technique may be that of catharsis by a sort of public confessional in which case we may speak of it as *confessional* group therapy (without confusion with the other and older use of the word "confessional"). There is another kind of group therapy in which transference interpretations are given of the behaviour of individuals and by inference of the group, called *analytical* group therapy.

Let us now consider the second kind of group therapy, which we owe to Dr. Bion. This, if I understand him aright, is primarily concerned with the behaviour of the group as a group, and less with the behaviour of individuals in it. The difference is very important theoretically, and therefore, in the long run, practically.

One of the characteristics of individuals, as distinct from groups, is that individuals have an infancy characterized by a long development from immaturity during which they are physically and socially dependent: if groups, *as groups*, have anything comparable with this we know as yet very little about it. Very gradually we are beginning to know something about the integration of individual personality; we know that it is both threatened and stimulated by unresolved emotional conflicts during infancy, and that its final achievement,

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which we call maturity, is never as rigid or as stable as the instinct-ridden "personalities" (if we may use the word) of the wild members of the lower species. Following, and perhaps developing, Freud's theories in "Group Psychology," we can see one way in which the psychodynamics of the individual influence the behaviour of the group—the dependent state during human infancy and the unresolved problems of that three-person relationship called the Oedipus complex (in both direct and inverted forms) leads to a search for and veneration of Leaders, who are identified with the ego-ideal, and to a bond through positive identification with those who share the same ego-ideal figure, and through a negative identification a hostility towards those who do not.

Such concepts, which are now so much the common stock of our daily thought that we find them in leading articles of our newspapers, give a valuable theoretical structure to those group therapies which concern, explicitly or implicitly, the treatment of several individuals assembled for remedy of neurotic disturbances, but I venture to think that such concepts deal with only a portion of the operative *group* dynamics.

If we were to divide the kinds of psychodynamics according to the number of particles or bodies or persons concerned, we could speak of one- and two-body psychologies which deal with reflexology, with the "higher neurology," and with those strange researches using the brass instruments of psychology which study persons in sound- and social-proof rooms of our laboratories—all this is one- or, at most, two-body psychology. A three-body psychology deals with all of the derivatives of the Oedipus complex, and this, as we have seen, is very useful in group therapy. There is perhaps—I repeat, perhaps—a multi-body psychology, which would, if it were articulate, that is to say adequately conceptualized, deal with the psychological forces operative when several or many individuals are together.

If, in an endeavour to understand the psychodynamics of a group, we employ as a model for our thinking the three dimensions of space, one co-ordinate can be represented by the one- and two-body psychology, another by the three-body psychology, and the third by the multi-body psychology. On this reckoning the three psychologies are complementary; but there is a corollary, viz. that an event (if, indeed, the theory is right) can only be "placed," i.e. accounted for, if cognizance is taken of the forces in all three psychologies, or, as one might call it, the three regions of psychological space.

At this point I expect to be challenged with the question—am I not advocating a herd instinct, and is not the psychology of the individual and of the horde (to quote Freud's term) enough? My answer is that horde psychology carries us a long way, and usefully, but I suggest that it carries with it a "field determined" limitation. It is based on research done in the two-body situation of the psychoanalysis of single persons who have failed to master the complexity of the three-body (Oedipal) situation, and who therefore *transfer* into every other situation those as yet unresolved three-body problems. This is likely to be particularly evident where individuals, still Oedipally handicapped, are assembled for remedy of three-body problems.

When groups of people, having already a structured relation to one another, call in a psychologist because of their discontent with their group relationship

and wish it bettered—when this occurs we shall have a situation in which multi-body psychology can be studied more easily, though, of course, the investigation will be complicated by the two other psychological factors. Without Freud's three-body theory, an examination of a multi-body situation becomes unmanageably complicated; in the study of human society Oedipean factors will always have to be reckoned with.

To return to the challenging question—about herd instinct. I see no objection to it; many animal species exhibit it; man certainly shows a tendency to shoal, or herd, or group together. Perhaps—again, perhaps—the herd impulse provides a matrix within which the multi-body as well as three-body forces operate. The trouble is that we lack as yet a wide-sweeping theoretical framework for multi-body psychology, without which group therapy (in the second sense I described at the outset) will lack its backbone of theory.

I am well aware that I have said nothing but commonplaces, and have added nothing whatever to the theories which may help us to explain in detail the behaviour of groups. My sole excuse for occupying your time with these banalities is that in our absorption with the tasks of applying three- and two-body theory we tend to overlook that groups, like animals, have, so far as we know, nothing like a human infancy.

[Transference, and transference interpretations, depend on the carrying-over into the present of past situations that have a different quality from those now existing. The child is different from the adult both structurally and functionally; Freud laid stress on this about fifty years ago, when he emphasized the importance of infantile sexuality, and subsequent researches have in no way diminished the importance of that discovery. Interpretations which only compare similar structures and functions are not "mutative," to use Strachey's term, and it does them undue honour to call such interpretations explanatory, because they miss the point; they are not, in fact, interpretations in the strict use of the term. Another feature of human infancy is that its most important behaviour and character-influencing qualities are repressed; there is something preventing "closure" to the unresolved conflicts; there is an amnesic gap in the experience of the individual which has to be filled in (not merely bridged by explanations) before the patient can obtain his full maturity. Furthermore, the therapeutic work with individuals mainly concerns the restitution of processes of growth within an organism whose boundaries can, generally speaking, be defined, and whose changes occur within a biological time scale proper to the species—"three score years and ten," as the Bible says. The art of interpretation lies partly in conveying to the patient the present operation of concurrent but discrepant patterns of behaviour which belong to different periods or positions in the time scale of that patient's growth. It is with these considerations in mind that one can say a group has no infancy, that the term "group interpretations" does not consist in filling in a gap between structurally and functionally different phases of an organism living in, and bounded by, a well-recognized and highly relevant time scale, and that such "group interpretations" are not intended to remove an amnesia. All this notwithstanding, it is possible that groups have phases (perhaps, indeed, lasting in some cases throughout their existence) characterized by such

instability of behaviour, such apparent unawareness of threats to their very existence, such unmindfulness of their relation to other groups and the community of which they are a part—because of these things it is tempting, but not useful, to speak of groups as being infantile. Our lack of comprehensive picture of group life inclines us to lean overmuch on analogies.*]

One of the main tasks of research, at least one that lies nearest to hand, is to discover the limiting factors in the operation of three-body psychodynamics in a multi-body situation.

* The portion in brackets was added to this paper as a result of the subsequent discussion.—J.R.

A PSYCHO-ANALYTIC APPROACH TO THE TREATMENT OF PATIENTS IN GROUPS.*

By HENRY EZRIEL, M.D.

DR. RICKMAN, in his address to-day, has raised the whole range of problems concerning the dynamics of groups. I think he has rightly drawn attention to the fact that "three-body" problems with which psychoanalysts are accustomed to deal form only part of the dynamics of a "multi-body," a group, and that a fuller understanding of the dynamics of a multi-body is bound to influence our therapeutic technique.

During the last twelve months I have paid a good deal of attention to multi-body dynamics, and though my observations and theoretical views on this subject are still too incomplete to be presented to a larger audience, I have recently tried to include in my interpretations *specific* multi-body problems, i.e. problems which can *only* arise in groups. My impression is that this, on the one hand, does more justice to the complexity of the behaviour observed in a group and therefore widens the scope of treatment to a considerable extent, and, on the other hand, that the discussion of multi-body problems does not make redundant the working through of unconscious two- and three-body conflicts, especially when the group members have originally come to the Clinic, not as a group but as individuals. I am therefore going to present to you to-day a technique which tries to make use of a group as a medium for the solution of three-body problems of individuals who come to us for treatment as individuals. Such individuals require help because, in their adult lives, they find themselves hampered by the intrusion from their unconscious of unresolved infantile three-body conflicts, i.e. the Oedipus situation. I mean by that, that in their infancy and early childhood such individuals did not manage to find satisfactory solutions (in Gestalt terms "closure") in three-body situations, in which they felt that *their* needs could not be satisfied because two other individuals, essentially their parents, seemed to gratify *their own* needs by excluding the child, our present-day patient.

In 1945 I had the good fortune of participating in the first patients' group which Dr. W. R. Bion took at the Tavistock Clinic. Though my present technique is in various respects different from what I learned there, Bion's principle of adhering strictly to "here and now" interpretations is also characteristic of my own approach.

My first group started more than four years ago, and some of its original patients are still under treatment. I can only say, therefore, that I have had a fair period in which to follow a few of the patients and to gain some impressions of the stability of the changes in their behaviour as a result of the method

* A contribution to a symposium on "Group Psychotherapy" at a Quarterly Meeting of the Royal Medico-Psychological Association, on 22 February, 1950.

used. It must be emphasized that I do not for a moment think that this strictly psychoanalytic technique is the only way of giving effective help to patients. It is not unreasonable to expect that future psychotherapists will have at their disposal a number of techniques which have been established as effective and economic for particular cases under particular conditions.

My approach to groups makes use of two trends in recent psychoanalytic thinking. The first is the development of a theory of "unconscious object relations"; the other is an increasingly "rigorous use of transference interpretations," originating from the work of Ferenczi (1), elaborated mainly by Mrs. Klein (2), and Strachey (3), and applied to groups by Bion (4).

The basic assumption underlying an approach, which makes consistent use of transference interpretations, is that the apparently incoherent thoughts and actions produced by the patient one after another in a temporal sequence belong together dynamically. That is to say, there exists a common unconscious dynamic source, a need, which sets up a tension in the patient's mind, and which tries to find relief through his establishing a certain kind of relationship between himself and his analyst in the "here and now" situation of the analytic session. This attempt is considered as one particular instance of a more general tendency, as one of many unconscious endeavours which the patient makes to establish such a relationship between himself and his environment in general.

The "transference situation" is therefore not something peculiar to treatment, but occurs whenever one individual meets another. A person's manifest behaviour contains (in addition to many consciously motivated patterns) features which represent an attempt to solve an unconscious tension arising from this person's relations with unconscious phantasy-objects, the residues of unresolved infantile conflicts.

In the analytic situation, which the patient enters to satisfy his conscious need for treatment, the adoption of a passive non-directive attitude by the analyst allows all these unconscious needs to emerge in the patient's attempts to establish appropriate relations with the analyst. Strachey (3) emphasized that it is only the analysis of this "here and now" relationship which represents a "mutative" interpretation, i.e. one which can permanently change the patient's unconscious needs, and hence his personality. A number of analysts (especially Rickman (5), whose point of view I am following) have gradually tended to the view that none other than transference interpretations *need* be used.

Now what happens when several people meet, as when we put several patients together into a group, and each of them brings to the group meeting some unconscious relationship with "phantasy objects," which may be dominant in his mind at that moment and which, unconsciously, he wishes to "act out" by manipulating the other members of the group into certain positions like pawns in a private game of chess? It has already been stated that in individual treatment, where the analyst (except when he interprets) takes up a passive, non-directive role, the patient will try to push him into roles which aim at relieving his unconscious tensions. The situation in groups

is that, though the analyst assumes his passive role, this is not so with regard to the other patients in the group. We therefore have to clarify what the behaviour of a fellow patient means to another group member.

Even in individual analytical practice there are sometimes incidents which allow us to see how an occasional non-interpretative action on the part of the analyst becomes included into the patient's unconscious phantasies. I am thinking of an individual patient whom I had kept waiting for a few minutes on a number of occasions. In one particular session, however, the fact of being kept waiting formed the major theme in his transference relationship with me, since it fitted into his then dominant unconscious phantasy of being kept waiting by another man and woman who made love to one another and excluded him—a phantasy which had found expression in a dream the night before.

The behaviour of fellow patients in a group seems to have effects similar to such non-interpretative actions on the part of the analyst. They act like the stimulus of a projection test, e.g. a Rorschach picture or a T.A.T., which elicits in the mind of the onlooker reactions born out of unconscious phantasies dominant in his mind at that moment.

The *manifest* content of discussions in groups may embrace practically any topic. They may talk about astronomy, philosophy, politics, or even psychology; but it is one of the essential assumptions for psychoanalytic work with groups that, whatever the manifest content may be, there always develops rapidly an *underlying* common group problem, a *common group tension* of which the group is not aware but which determines its behaviour. This common group tension seems to represent what I should like to call the “common denominator” of the dominant unconscious phantasies of all members. In the beginning of each session there is always some probing when some member of the group, who seems to feel a particular urge to speak, broaches one subject or another. Often a remark made by one member is not taken up by anybody, apparently because nobody can fit it into what is unconsciously at the back of his or her mind. If, on the other hand, it can be fitted in (as the incident of being kept waiting was taken up by the individual patient quoted before), if it “clicks” with the unconscious phantasy of another member, and then perhaps with that of a third, then gradually the subject catches on and becomes *the* unconsciously determined topic of the group until the next interpretation produces “closure” of this particular phase of the session. Apparently this is so because some aspect of the subject under discussion represents something relevant to the dominant unconscious phantasy in each member's mind. In dealing with this common group tension every group member takes up a particular role, characteristic for his personality-structure, because of the particular unconscious phantasy-object relations which he entertains in his mind, and which he tries to solve through appropriate behaviour in the group. When several people meet in a group each member projects his unconscious phantasy-objects upon various other group members and then tries to manipulate them accordingly. Each member will stay in a role assigned to him by another only if it happens to coincide with his own unconscious phantasy and if it allows him to manipulate others into appropriate roles. Otherwise he will

try to twist the discussion until the real group *does* correspond to his phantasy-group. It is by analysing the role which each group member takes up in dealing with the common group tension in the "drama" performed in that session by the group as a whole, that we can demonstrate to each group member his particular defence mechanism in dealing with some unconscious tension of his, and we do this in the same manner as in individual psychoanalytic sessions.

To give an example: in the first part of a session a female patient had made a remark about the group's behaviour, with which I showed agreement when I made an interpretation to the whole group later on. As soon as I had finished speaking a male patient immediately remarked upon my agreeing with that female patient, and said that I was favouring her. Then there was a silence of several minutes and one male patient suddenly suggested that one should discuss politics. Another man picked up the suggestion, and started a discussion on the respective merits of socialism and communism and, although such ideas were quite out of keeping with the usual views of the group, in that particular session all the men and one woman seemed to turn communist. The main issue was that "political" democracy without "economic" democracy was really a disguised form of dictatorship. They pointed out especially that the owner of a factory could always sack people as he liked, and even seduce his typist. The female patient I had quoted before remained silent, but looked worried and embarrassed. Another female patient agreed with the men. The third female patient, however, disagreed and thought that these communist views were only a disguised form of greed which one must not have, that all the misery in the world, and all the quarrels and wars, were only due to greed, because somebody could not tolerate anyone else having something which they had not got themselves. The discussion became more and more heated and suddenly broke off. After a short silence, somebody started teasing the notoriously weakest male member of the group, and this teasing very soon turned into a rather unpleasant attack on him.

What was the *unconscious* problem the group was dealing with in that session? When I asked myself my usual psychoanalytic question—what makes these people say these things at this moment?—the answer became obvious. The common group problem was what they felt to be my "flirting" with the "favoured" female patient. The factory owner who could sack people, and who could even seduce his typist was obviously myself "favouring," as one of the male patients had pointed out, the female patient with whose remark, in the first part of the session, I had agreed. It was, by the way, the same male patient who, on many previous occasions, had pointed out that one could not criticize me because I might refuse to treat whoever criticized me, and even turn that particular person out of the group, and stop him from attending any further, in other words, sack him. The men obviously resented that I could, so they imagined, use my position as a doctor—as the "owner of the means of production," the man who could give or deny treatment—in order to make love to a female patient, while they were apparently barred from doing the same. Moreover, the female patients seemed to prefer me, as the "owner of the treatment factory," who had something to offer which they

badly required. The female patient who had agreed with them was one who, on many previous occasions, had openly expressed affection for me, and was apparently very annoyed and jealous that I seemed to favour another woman in preference to herself. The so-called "favoured" patient unconsciously seemed to have felt that the attack was directed not only against me but also against her, and therefore remained in embarrassed silence. And finally, the female patient who had accused the others of greed was one who had, herself, considerable problems with regard to her own unconscious greed which found expression in a symptom, viz. an inhibition about eating in front of certain people. Her behaviour was obviously a reaction formation, an attempt to deny her greed, and to fight against that part of herself which she felt was so greedy and might get her into trouble. Finally, the attack against the weakest member of the group, after the political discussion, was obviously a displacement of hostility from me to that male patient, whom they were less afraid to attack. When I made these remarks to the group, the woman who had agreed with the communist beliefs openly admitted her jealousy, the men, on the other hand, equally openly turned against me and started criticizing my treatment, its "uselessness," my having been late at a particular session, and so on.

Time does not allow me to go into many problems of technique. I do want, however, to raise one more point. My interpretations are directed primarily to the "common denominator," the common group tension, and any particular patient's reactions are only referred to in so far as two things can be shown to him: (a) that his behaviour represents his specific way of coping with this *common* group tension; (b) *why* he acts in this way in preference to other ways of dealing with this group problem. A patient in a group may, for instance, often try to obtain a "private interview" within the group session by offering "tempting" material to the analyst. He may recount a dream or some outside experience, or describe his symptoms in great detail. On such occasions I pick out of his material only what seems to me to be relevant to the common group tension.

A male patient, for instance, who in preceding sessions felt rejected by the women of the group gave a long narrative of difficulties with his wife. He then asked me to do something about it outside the group, since this was a "real" problem. In interpreting this material, I pointed out to him only those features that seemed to me relevant with regard to the inter-personal relations prevailing in the whole group at that moment, namely, that he was trying to secure my help against the supposedly overpowering female members of the group. I did not refer to various other things that he had mentioned on this occasion. Several difficulties which he had with his children, if reported in an individual session, would no doubt have had to be interpreted as signifying something quite different, since they would then represent material elicited in a "two-person transference" relationship. I only took them up in the group session as demonstrating his wife's "badness." I think that in this respect this technique differs from that of many other group workers, and also from the technique followed by many analysts who, as far as one can gather from published accounts of their group work, tend to interpret a patient's remarks independently of the common group tension. I use material only in so far as

it finds expression in the "here and now" relations of the group members toward one another, i.e. as it forms part of the general group tension; I do not go beyond that.

I have tried to present to you a brief account of the essential features of a psychoanalytic approach to group treatment as practised at present by myself, and in a similar form by several other analysts at the Tavistock Clinic, and the results of which we have found encouraging. I wish to emphasize, once more, that this particular technique is still in its early stages of development and it is certainly not the only kind of group treatment that helps patients.

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THE THIRD INTERDIGITAL PATTERNS ON THE PALMS OF THE GENERAL BRITISH POPULATION, MONGOLOID AND NON- MONGOLOID MENTAL DEFECTIVES.

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INTRODUCTION.

IN the study of palm prints, a human palm is generally divided into five areas: hypothenar, thenar-first-interdigital, second, third and fourth interdigitals, in each of which various configurations can be observed. These configurations range in form from whorls, loops and vestiges to absence of patterns, i.e. plain structures, called open fields. Whorls are patterns each with two triradii, and loops each with only one triradius. Vestiges, which are local disarrangements of epidermal ridges, vary from resembling a true pattern to approaching an open field.

The area called the third interdigital is located at the distal end of the palm, between the bases of the third and fourth fingers. The configurations in this area have been described by Wilder (1930), who traced the transitions from one type of configuration to another. The bilateral asymmetries and configuration frequencies in European-American and German populations have been studied by Cummins, Leche and McClure (1931), and by Cummins and Midlo (1943), who found that third interdigital patterns occurred more often on the right hands than on left hands, and that the frequency of patterns, including vestiges, was about 40 per cent. for 300 European-Americans, and 54 per cent. for 1,281 German males. The proportion of persons showing bilateral asymmetries in this area has not been analysed.

The genetics of the third interdigital patterns in the general German population have been investigated by Weinand (1937), who concluded that the presence of pattern was controlled by a pair of recessive genes. This is not apparent from his data, for, if the presence of pattern was a fully manifesting recessive character, the matings between two bilaterals (that is, two persons with third interdigital patterns on both hands) should produce nothing but bilaterals among their offspring. This was not so. Among the offspring from this type of mating there were seven unilaterals (persons with third interdigital patterns on one hand only) and one child with an open field, in the third interdigital area, on both hands. In other words, the unitary nature of the character has not been demonstrated. Similar inconsistencies can be found in the study of the genetics of other palmar patterns. This is partly due to the fact that little statistical analysis has been used.

The third interdigital configurations have been studied by Cummins (1939), Workman (1939) and Snedeker (1948) in mongoloid imbeciles. The results of Workman's investigation have not been published, but they are said to agree with the findings of Cummins, who found that the frequency of the third interdigital patterns, including vestiges, in mongoloids was 89.3 per cent. for 56 right palms, and 70.2 per cent. for 47 left palms. The difference in frequency of the character between mongoloids and the general population was not regarded as significant. The results of the present investigation on the same character agree, on the whole, with those of Cummins and Snedeker. The frequency of the third interdigital patterns, including vestiges, in the mongoloids was found to be 92.7 per cent. for 410 right palms and 79.5 per cent. for 410 left palms. This was nearly twice as great as that in the control population.

The third interdigital configurations in non-mongoloid defectives have not been previously studied. It was found, in the present investigation, that the non-mongoloid defectives and the control population did not differ significantly from each other in either the morphology or the frequency of the character.

MATERIAL AND METHODS.

The material used in this investigation is the same as that used in the study of the *a-b* ridge count on the palm (Fang, 1949, 1950), and is kept in the Galton Laboratory. It consists of—

1. Control population—926 unrelated British individuals, 462 males and 464 females.
2. Control families—85 British families.
3. Twins—63 pairs of identical twins.
4. Mongoloid imbeciles—205 unrelated mongoloid imbeciles, 98 males and 107 females.
5. Mongoloid families—98 families in which at least one member is a mongoloid imbecile.
6. Non-mongoloid defectives—271 male and 241 female unrelated defectives.

The method used is chiefly concerned with the identification of the various types of configurations described by Cummins and Midlo (1943). Provided that the area has been clearly printed one can usually identify the type of configuration in the third interdigital area under a lens. Occasionally a puzzling situation may be met when a vestige approaches an open field or when it has a slight tendency towards a loop. This is because the variation from an open field to a loop, or some other pattern, is continuous.

MORPHOLOGY.

The third interdigital area (Fig. 1) is usually bounded by the digital triradii *b* and *c*, and by the palmar main lines *B* and *C*. Since the triradius *b* is nearly always present and the main line *B* very seldom takes part in the formation of any third interdigital pattern, the type of the third interdigital configuration is thus chiefly conditioned by the presence or absence of the triradius *c* and by the course of the main line *C*.

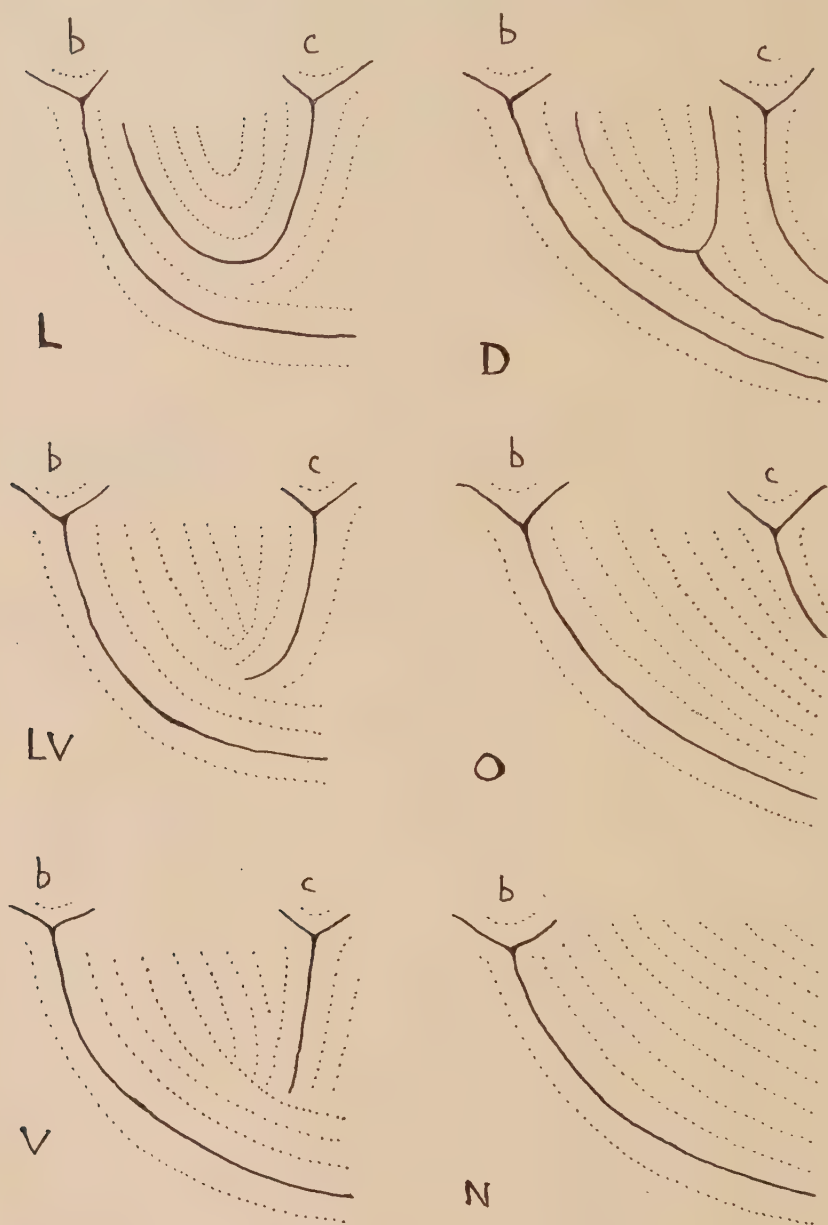


FIG. 1.—Diagram showing the types of configuration between the digital triradii *a* and *b*: heavy lines are the radiants of the triradii.

L = loop without an accessory triradius.

LV = vestige with a distinct tendency towards a loop.

V = vestige without a distinct tendency towards a loop.

O = open field.

N = absence of the triradius *c*.

D = loop with an accessory triradius.

When the triradius *c* is absent, the third interdigital configuration usually looks like an open field or a vestige. The frequency of absence of the triradius *c* on either hand was about 4 per cent. in the males and 7 per cent. in the females.

When the triradius *b* and *c* are very near together, as in the case of syndactyly, the third interdigital configuration is often a loop. In some cases of syndactyly where the triradii *b* and *c* fuse, the third interdigital area can be regarded as absent.

Though the main line *C* is the proximal radiant of the triradius *c*, the presence of this triradius does not necessarily imply the presence of a main line *C*. Not rarely the main line *C* is very poorly developed or abortive, in which case the third interdigital configuration usually looks like a vestige; in about half of the cases this has a tendency towards a loop.

When the main line *C* is well developed it usually terminates in one of the following regions: (i) the third interdigital area, (ii) the fourth interdigital area, or (iii) the hypotenar margin. In the first case the third interdigital configuration is a loop; in the second and third cases it is an open field, except when there is an accessory triradius.

Accessory triradii in this area occurred in less than 1 per cent. of the control population. When they are present they are accompanied by loops or small whorls. Whorls and loops with accessory triradii differ qualitatively from ordinary loops formed by the main line *B*.

To sum up, the types of configurations found in the third interdigital area, on either hand in all samples studied, are these:

<i>Configuration.</i>	<i>Symbol.</i>
1. Whorls	<i>W</i>
2. Loops with accessory triradii	<i>D</i>
3. Loops without accessory triradii	<i>L</i>
4. Vestiges with distinct tendency towards loops	<i>LV</i>
5. Vestiges without distinct tendency towards loops	<i>V</i>
6. Open field	<i>O</i>

The types of configurations on the right and left hands together are these:

<i>Configuration.</i>	<i>Symbol.</i>
1. Third interdigital patterns, <i>W</i> , <i>D</i> , <i>L</i> or <i>LV</i> , present on both hands	<i>Bil. or bilateral.</i>
2. Third interdigital pattern, <i>W</i> , <i>D</i> , <i>L</i> or <i>LV</i> , present on one hand only	<i>Uni. or unilateral.</i>
3. No pattern present on either hand, but vestiges present at least on one hand	<i>VO</i>
4. Neither pattern nor vestige in the investigated area on either hand	<i>OO</i>

ASYMMETRIES.

The third interdigital configuration on the right hand can be the same as, or different from, that on the left hand of an individual. In other words, there are bilateral symmetries and asymmetries with respect to the character in question (Table I). Among the control population 44.4 per cent. of males and 42.2 per cent. of females showed bilateral asymmetries. Similar observations were recorded in mongoloid and non-mongoloid defectives (Table II).

TABLE I.—*Bimanual Distribution of the Third Interdigital Configuration in the General British Population.*

		Males shown thus : 1.				Females shown thus : (1).			
Right hand.		Left hand.						Sum.	
		W.	D.	L.	LV.	V.	O.		
W	.	1	..	..	..	..	..	.	1
							(1)	.	(1)
D	.	..	1	2	..	1	3	.	7
			(1)	(1)			(2)	.	(4)
L	.	..	1	92	32	35	62	.	222
			(1)	(86)	(27)	(27)	(70)	.	(211)
LV	.	..	..	1	5	3	13	.	22
					(1)	(7)	(13)	.	(21)
V	.	..	..	1	1	8	19	.	29
				(3)	(1)	(6)	(18)	.	(28)
O	.	..	..	16	7	8	150	.	181
				(8)	(9)	(8)	(174)	.	(199)
Sum	.	1	2	112	45	55	247	.	462
			(2)	(98)	(38)	(48)	(278)	.	(464)

TABLE II.—*Percentage Frequencies of Asymmetries with regard to Third Interdigital Configurations in the Control Population, Non-mongoloid Defectives and Mongoloid Defectives.*

	Control population.		Non-mongoloid defectives.		Mongoloid defectives.	
Male	.	44.4	.	47.2	.	48.0
Female	.	42.2	.	41.1	.	35.5

Asymmetries on all samples studied were characterized by the fact that complicated configurations were observed more often on right hands than on left hands. For instance, if an individual had only one third interdigital pattern, this was more often than not on the right hand. With open fields it was almost the other way round. Furthermore, third interdigital loops were generally bigger and more fully developed on right hands than on left.

FREQUENCIES.

Significant differences were observed in the frequencies of the third interdigital configurations between the control population and mongoloid defectives. This can be represented in two ways: (i) on right and left hands separately (Table III). The difference in the frequencies of loops (L) on the right hands in these two samples was + 35.6 per cent., with a standard error, 3.2 per cent.; of loops on the left hand was + 29 per cent., with a standard error, 4.3 per cent.; of open fields on the right hands was - 33.7 per cent., with a standard error, 2 per cent.; and of open fields on the left hands was - 30.2 per cent., with a standard error, 3.3 per cent. (ii) On right and left hands together

TABLE III.—*Comparison of Percentage Frequencies of Third Interdigital Configuration in the Control Population, Non-mongoloid and Mongoloid Defectives.*

Con- figuration.	Right hand.			Left hand.		
	Control (926).	Non- mongoloid (512).	Mongoloid (205).	Control (926).	Non- mongoloid (512).	Mongoloid (205).
<i>W</i>	0.2	0.2	..	0.1	..	..
<i>D</i>	1.2	2	1.5	0.4	0.2	0.5
<i>L</i>	46.8	44.3	82.4	22.7	21.3	51.7
<i>LV</i>	4.6	5.1	4.4	9	6.5	10.2
<i>V</i>	6.2	7.8	4.4	11.1	15	16.1
<i>O</i>	41	40.6	7.3	51.7	57	21.5

The frequency of patterns, including vestiges, on right hands is 92.7 per cent. in mongoloids, and 59 per cent. in controls; that on left hands is 79.5 per cent. in mongoloids, and 48.3 per cent. in controls.

(Table IV). The difference in the frequencies of bilaterals between these two samples was + 34.3 per cent., with a standard error, 3.6 per cent., and of *OO*'s was - 29.2 per cent., with a standard error, 2.4 per cent.

TABLE IV.—*Comparison of Percentage Frequencies of the Bimanual Third Interdigital Configuration among Control Population, Non-mongoloid and Mongoloid Defectives.*

Bil. = Third interdigital patterns on both hands.

Uni. = " " " on one hand only.

VO = No third interdigital pattern on either hand, vestiges on at least one hand.

OO = Neither pattern nor vestige in third interdigital area on either hand.

LV treated as *L*.

Bimanual con- figuration.	Control population.			Non-mongoloid defectives.			Mongoloid defectives.		
	Male (462).	Female (464).	Aver- age.	Male (271).	Female (241).	Aver- age.	Male (98).	Female (107).	Aver- age.
<i>Bil.</i>	29.2	25.2	27.2	25.1	23.2	24.2	56.1	66.4	61.5
<i>Uni.</i>	30.7	30.4	30.6	35.4	26.1	31	31.6	24.3	27.8
<i>VO</i>	7.6	6.9	7.2	6.6	12.5	9.4	7.2	2.8	4.9
<i>OO</i>	32.5	37.5	35	32.9	38.2	35.4	5.1	6.5	5.8

No significant differences were observed in the configuration frequencies in the control population and non-mongoloid defectives.

INHERITANCE.

The heritability of the third interdigital configurations was shown by the estimated correlation coefficients between relatives. The father-child correlation coefficient was 0.32, mother-child 0.26, total parent-child 0.43, sib-sib 0.27, and identical twins 0.78 (Table V).

The regression line of the character in offspring on that in total parents was calculated. Deviation from linearity was found to have a probability not far from 0.2. This indicates that there is probably no recessivity in the character.

TABLE V.—*Correlations of the Third Interdigital Configurations between Relatives in the Control Families.*

(The correlations were calculated by assigning numerical values to various phenotypes.)

Type of pair.	Number of pairs.	$r \pm \text{s.e.}$
Father-child . . .	182 . . .	0.32 ± 0.07
Mother-child . . .	182 . . .	0.26 ± 0.07
Total parent-child . . .	182 . . .	0.43 ± 0.06
Sib-sib . . .	361 . . .	0.27 ± 0.05
Identical twins . . .	63 . . .	0.78

Attempts were made to analyse the mode of inheritance. It was found that the present collection of pedigrees, in the control and mongoloid families, was not sufficient for this study. Any further genetic studies on this character have to take the following two points into consideration: First, since the character is susceptible to environmental changes (as the correlation coefficient in identical twins has shown), phenocopies are probably present. Secondly, since the variation from an open field to a pattern is continuous, the classification of some types of configuration is frequently arbitrary.

MONGOLISM AND THIRD INTERDIGITAL PATTERNS.

The frequency of persons with at least a third interdigital pattern (*W*, *D*, *L* or *LV*) on one hand was about 89 per cent. in the mongoloid defectives, and 52 per cent. in the control population. A test for homogeneity, by a $2 \times n$ table, among members of mongoloid families, revealed the following facts (Table VI).

TABLE VI.—*Comparison of the Frequencies of the Bimanual Third Interdigital Configurations in the Control Population and Members of Mongoloid Families.*

Con-figuration.	Control population.		Mongoloid families.							
			Parents.		Offspring.					
					Mongoloid.		Non-mongoloid.		Total.	
	No.	%.	No.	%.	No.	%.	No.	%.	No.	%.
<i>Bil.</i> . .	252	27.2	63	32.1	55	55	48	34.8	103	43.3
<i>Uni.</i> . .	283	30.6	57	29.1	29	29	36	26.1	65	27.3
<i>VO</i> . .	67	7.2	22	11.2	9	9	10	7.3	19	8
<i>OO</i> . .	324	35	54	27.6	7	7	44	31.9	51	21.4
Total . .	926	100	196	100	100	100	138	100	238	100

Test of homogeneity by a $2 \times n$ table, number of degrees of freedom = 3.

1. Between parents of mongoloids and control population : $\chi^2 = 4.59$.
2. " " " and total offspring : $\chi^2 = 6.46$.
3. " " " and mongoloid offspring : $\chi^2 = 22.34$.
4. " " " and non-mongoloid offspring : $\chi^2 = 2.29$.

1. The mongoloid offspring deviated significantly from their parents, but the non-mongoloid offspring did not do so.

2. The parents and non-mongoloid offspring did not differ significantly from the control population.

3. A consistent decrease in the frequency of *OO*'s from the control population to parents of mongoloids and to mongoloids was observed.

4. As matings between two *OO*'s in the mongoloid families have produced four bilateral offspring, all of whom are mongoloids, this indicates that the conditions favouring the formation of mongolism also favour the development of third interdigital patterns.

SUMMARY.

1. The variation of the third interdigital configuration was found to be continuous, though the intermediates were few.

2. Bilateral asymmetries were conspicuous in the area investigated, and more pronounced in males than in females.

3. Heritability of the third interdigital patterns was shown, but no recessivity in the character was demonstrated. The variation of the character could not be explained by any simple genetic hypothesis.

4. The mongoloid defectives did not differ significantly from the control population in the morphology of the patterns, but did so in the frequency of the character.

5. The parents of mongoloids did not differ significantly from the control population in the frequencies of the character, though they tended to have fewer *OO*'s and more bilaterals than the controls. This tendency was accentuated in mongoloid offspring.

6. The total offspring, including mongoloids, did not deviate significantly from their parents, though the mongoloid offspring did so from their sibs and parents.

7. No significant differences were found in the control population and non-mongoloid defectives with regard to the morphology, asymmetries and frequency of the character in question.

ACKNOWLEDGMENTS.

The writer is gratefully indebted to Professor L. S. Penrose for suggestions and criticism.

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ELECTRONARCOSIS : A SAFE TECHNIQUE FOR ROUTINE ADMINISTRATION UNDER ANAESTHESIA AND EULISSEN (DECAMETHONIUM IODIDE OR C.10).

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ELECTRONARCOSIS (E.L.N.) is a state of unconsciousness brought about by the passage of an electric current through the forebrain. The current has a much lower milliamperage than that which is used in electro-convulsive therapy (E.C.T.).

In view of considerable dangers reported to be inherent in electronarcosis—e.g. by Garmany and Early (1948)—it is proposed to describe a method which is both simple and free from danger. It is felt that these dangers have been so emphasized that what might be a most valuable type of treatment is being abandoned. The method to be described was administered to 70 patients, and a total number of 600 treatments were given without serious complications. When first used for patients who had failed to respond to the already well established shock therapies a number of complications were seen; these included burns at the site of contact between the electrodes and the skin of the forehead, dangerous apnoea, prolonged delays in recovery from treatment, apprehension and refusals. Most of these were due to faults in our technique; in the absence of anaesthesia and curarization, considerable experience and skill were needed to keep the patients smoothly under electronarcosis. It was decided that the treatment should be carried out in the operating theatre containing the most modern equipment, with the aid of a skilled anaesthetist able to deal with the purely anaesthetic emergencies, and with a completely reliable method of laryngeal relaxation to ensure a clear airway. In this way an adequate depth of electronarcosis could be maintained throughout.

A standardized method of treatment based on that described by Paterson and Milligan (1947) was developed. Anaesthesia and muscular relaxation were produced by the intravenous injection of thiopentone sodium and d-tubocurarine, and we followed the modification of this technique first suggested by Caplan (1948). On the recommendation of Dr. J. P. Cuddigan, our anaesthetist, tubocurarine was replaced by C.10 in August, 1949.

The treatment was carried out on three mornings a week. Each session started at 9 a.m. and lasted about 2½ hours, 8 to 10 minutes being allotted to each patient. To ensure a quick turnover of cases with the maximum safety from risks, it was essential that it should be under the control of an efficient team, consisting of a specialist anaesthetist, the psychiatrist, a theatre sister, a nurse to assist the anaesthetist, and at least two orderlies for transporting patients. The first patient is under observation in the recovery room, while

the second one is on the operating table undergoing treatment and the third is waiting in an adjoining room.

When E.C.T. was preferred to E.L.N., these additional cases could be included in the same session, following the technique described by Hobson and Prescott (1947).

PREPARATION AND PRE-MEDICATION.

On the day before treatment a list is published which includes the names of the in-patients and out-patients, the ward, the number of previous treatments and the recommended dosages. No solid food is taken by mouth for at least 4 hours before the treatment begins, but a morning cup of tea, "sweetened to taste," is permitted on waking. The bladder is emptied just before entering the theatre. One hour before the treatment begins the patient is given atropine, gr. $\frac{1}{160}$ to $\frac{1}{80}$, or scopolamine, gr. $\frac{1}{160}$ to $\frac{1}{80}$, but no patient over the age of 60 is given scopolamine.

EQUIPMENT.

The operating table, which has an adjustable arm-rest at the side, is covered with a Dunlopillo mattress, on top of which is placed a canvas stretcher with strong rope loops. A small firm pillow is used as a head-rest. Two stretcher trolleys are available for taking patients back to their wards.

The anaesthetic apparatus in use is a standard Boyle machine with a Coxeter-Mushin carbon dioxide absorber. The trolley also has an emergency tray with a laryngoscope, laryngoscope forceps, gauze swabs, Mason's gag, Guedel rubber airways and Magill's tracheal tubes.

The anaesthetist's table :

- (i) Bowls containing sterile water, sterile swabs, spirit.
- (ii) Kidney trays for sterile syringes.
- (iii) Syringes, sizes 10 and 20 c.c.
- (iv) Short-bevelled needles, sizes 17 and 18.
- (v) Thiopentone sodium in bottles containing 5 gm.
- (vi) C.10 in 2.5 c.c. ampoules.
- (vii) Sterile glass tube for mixing purposes.
- (viii) Large needle for drawing up.

Treatment trolley with—

- (i) The Shotter-Rich electronarcosis apparatus.
- (ii) Pair of electrodes (see below).
- (iii) Bowl of 20 per cent. saline (for saturating gauze pads).
- (iv) 2-in. square pads of 16 thicknesses of gauze with stitched edges.
- (v) Smith time-keeper clock, indicating minutes.
- (vi) Sphygmomanometer.
- (vii) Plexacon electroshock apparatus.

Emergency tray—a table containing pentamethonium iodide, as an antidote for C.10, nicamide, amyl nitrite, picrotoxin, and adrenaline.

It has long been considered advisable to have a suction apparatus and a tipping table in the remote event of regurgitation of stomach contents.

TECHNIQUE.

In my experience the electrodes supplied with the E.L.N. machine, are difficult to manage. A pair of electrodes designed by Dr. B. P. Armstrong are now being used instead. Each one is made of nickel-plated brass, $1\frac{1}{2}$ in. square, and slightly concave to fit the forehead comfortably. On the back of the electrode there is a bridge soldered on, about a quarter of an inch high. The centre of each bridge has a binding screw to hold a terminal. Two metal hooks connected by a narrow rubber head band, 1 in. in width, engage holes on the outer side of the bridge of the electrodes. There is a metal bar on the inner side of each bridge, through which an adjustable rubber strap is passed, thus holding the two electrodes together.

On entering the theatre the patient is asked to lie on the table with the head raised in a comfortable position on the small pillow. The arm into which the injection is to be made is stretched out on the arm rest at one side. When a patient is having treatment for the first time, a small dose of C.10 is injected intravenously, slowly at first to allow for the possibility of idiosyncrasy, and this is followed by thiopentone. At the second treatment the most suitable dose of thiopentone sodium and C.10 can be mixed and given from the same syringe. The dose of thiopentone varies from 0.4 gm. to 0.6 gm. and the C.10 from 1.5 mgm. to 5.0 mgm.

Two of the gauze pads, saturated in 20 per cent. warm saline, are placed about 1 in. apart on the forehead, the skin of which has previously been smeared with saline jelly (3 per cent. NaCl in tragacanth jelly). The electrodes are placed on top of these pads and then connected to the hooks on the rubber head band. It is essential that this head band should be tight and maintain firm, even pressure at the site of contact of the electrodes. About one and a half minutes after the injection the current is turned on at 200 milliamperes, or at zero and rapidly increased to 200 milliamperes, and is kept at this level throughout the treatment. Both these methods are used and seem to be equally effective.

There is an immediate modified tonic response, followed by an initial apnoea for some 30 to 40 seconds. When breathing begins it is extremely shallow, almost imperceptible; it is sometimes necessary to start insufflating the lungs with oxygen at this stage. Sometimes a good respiratory exchange is quickly established and the treatment continues without further oxygen; at other times there is a persistent apnoea and, since the vocal cords have now completely relaxed, constant insufflation with oxygen can be maintained easily by means of the Coxeter-Mushin bellows.

If a modified convulsion occurs the treatment is temporarily interrupted by the reduction of the current. After the cessation of the fit and when breathing begins again the current is quickly returned to 200 m.a. and the treatment is continued.

A time-keeper clock is set for 5 minutes, which seems an adequate time for the duration of each treatment. When a bell rings the current is switched off and the electrodes are removed. The patient is transferred on the canvas stretcher to a trolley and taken to the observation room next door to the theatre, as soon as the anaesthetist is satisfied that there is sufficient amplitude in the breathing to maintain adequate oxygenation. The patient is kept under observation in this room until there are signs of returning laryngeal reflex. It is then safe to take the patient back to the recovery ward. Strict observation is continued for at least 20 minutes, by which time the effects of thiopentone and C.10 have worn off.

COMPLICATIONS AND THEIR PREVENTION.

Burns.—In order to prevent the development of first degree burns at the site of contact between the electrodes and the skin, it is essential that a well-fitting rubber head band should hold the electrodes firmly in position, and thus maintain uniform pressure on the forehead. In this way the concentration of current at points, rather than over a wide area, is avoided.

Consciousness.—A painful awareness of the treatment in progress is seen occasionally in tense, over-anxious patients and is a very disturbing complication, sometimes leading to intense antagonism and refusal of further treatment. It occurs in lightly anaesthetized patients when the laryngeal spasm necessitates the reduction of the current and cessation of electronarcosis. When the current is switched on at 200 m.a. in a fully anaesthetized and curarized patient pain and flashes of light are not experienced. The state of narcosis remains smooth and constant.

Restlessness during the treatment may also occur when similar unfavourable conditions are present.

Collapse is liable to occur in old and debilitated people if there is inadequate oxygenation, and cyanosis must not be tolerated under any circumstances.

Transient signs and symptoms which occur in some patients after treatment are :

(i) *Occasional intense headaches* which tend to last for several hours ; they are always relieved by tab. codein. co. There is no obvious relationship between this symptom and the mode of treatment.

(ii) *Memory disturbances*.—The presence of memory loss or confusion varies enormously from patient to patient, and can vary after each treatment in the same patient.

(iii) *Thrombosis of veins*.—Frequent injections of thiopentone and C.10 are liable to cause a thrombosed vein. It is recommended that the arm be raised and the veins gently massaged centripetally after the injection. It has been observed that thrombosis of veins does not occur so frequently with C.10 and thiopentone mixture as it did with d-tubocurarine and thiopentone.

CLINICAL MATERIAL.

When electronarcosis was first introduced into this country from the U.S.A. by Paterson (1946), it was thought that it might be a substitute for insulin coma therapy in the treatment of schizophrenia. It is now known that it cannot replace insulin shock, and there is scanty evidence to show that it has a specific effect upon schizophrenia.

In this series the treatment was given to three distinct groups of cases, while a fourth group was treated by both electronarcosis and electroshock.

Depression.—There were 32 cases in a mixed group of depressive syndromes.

(a) Nineteen of these had previously been treated with E.C.T. and had relapsed. A course of E.L.N. resulted in 15 remissions, but 4 did not improve.

(b) The remaining 13 cases had no history of previous psychiatric disorder ; 9 cases recovered, and 4 were only slightly improved.

Schizophrenia.—There were 25 cases of schizophrenic reaction. This group was also mixed, and included cases, between the ages of 18 and 30, that had failed to respond to insulin coma therapy. There were also a series of paranoid states, chiefly in patients over 30. Electronarcosis resulted in 3 recoveries, 6 showed considerable improvement, 5 were slightly improved, 4 failed to respond and eventually had leucotomy, 3 failed to respond and were given deep insulin, 4 showed no improvement.

Psychoneurosis.—Thirteen cases ; 9 were chronic anxiety states, of whom 6 improved ; 4 were obsessive compulsions, 3 improving.

In addition to these, each session included a number of treatments for aged, debilitated, senile and arteriosclerotic patients by electro-shock, modified by C.10, and it is now becoming a routine method of treatment for patients over 70.

SUMMARY AND CONCLUSIONS.

This report deals with 18 months' experience with electronarcosis.

The establishment of a technique by the use of thiopentone and C.10 is described. It is dependent upon an efficient team and correct doses of thiopentone and C.10, as well as upon the anaesthetist's ability in caring for the apnoeic patient.

Electronarcosis is a relatively safe form of physical therapy, and complica-

tions should not arise if the technique as described above is correctly carried out. In this series the few experienced could all be traced to errors in technique.

Patients are surprisingly undisturbed throughout the whole course of treatment, and are able to carry out their usual activities within 3 hours.

In this hospital there has been a gradual reduction in the use of chemical narcosis through the introduction of E.L.N.

It is particularly noticeable that patients who are familiar with the nature of epileptiform convulsions prefer "shock" treatment with anaesthesia and curarization rather than without it, and have no hesitation in accepting E.L.N. and E.C.T. under the above conditions.

In contrast to d-tubocurarine, C.10 has the following advantages: it has a quicker action, and produces as good, if not better, relaxation of the vocal cords. There is less involvement of the respiratory muscles. Its effects wear off more quickly, and the period under observation in the recovery room is much reduced.

With increasing experience and confidence in the technique an increasingly larger number of senile patients are being treated.

At this stage no claim is made that the method described is superior to other forms of shock therapy, but, in certain patients, it does produce striking results where other methods have failed. There is some evidence to suggest that the paranoid reaction in older patients responds well to electronarcosis.

I am indebted to Dr. D. N. Parfitt, Medical Superintendent of Holloway Sanatorium, for permission to publish this report; also to Drs. J. P. Cuddigan and B. P. Armstrong, our anaesthetists, who have been chiefly responsible for making the psychiatrist's task so easy.

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THE ORIGIN OF HEAD-BANGING: A SUGGESTED EXPLANATION WITH AN ILLUSTRATIVE CASE-HISTORY.

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IN this short paper I shall set out a theory of the origin of head-banging and head-rolling which I do not claim has never been advanced before (since my reading has admittedly been far from exhaustive), but which I personally have not so far encountered in the literature, and which is certainly not widely known at the present time.

The failure of most books on neurotic disorders in childhood to deal more than cursorily with these two symptoms is chiefly due, no doubt, to the relative unimportance of the latter. Nevertheless, there are cases in which one or other symptom is the presenting complaint for which the mother seeks advice, and one moreover which she often appears to find remarkably disturbing (for a variety of reasons into which I shall not enter now), even when there is no question of the child's doing himself physical harm. It seems worth while, therefore, to offer this simple explanation of their origin.

Sitting before the fire alone one evening round about Christmas, 1948, the rest of the household having retired to bed, I began, after a while, to try to analyse the marked feeling of peace and well-being I was then experiencing. I was warm and well-fed, I had just drunk my nightly cup of tea, all was quiet save for the purring of the fire and the tick-tock of the old clock on the mantelpiece. Associations led me shortly to the memory of times before my father's death when he and I had sat in companionable silence in a sleeping house, smoking a last cigarette before going to bed, and here, too, I presently realized, I seemed to remember the slow ticking of our grandfather clock as an integral element in the total sum of our content. But it suddenly struck me that the old clock had stood in the hall and could not possibly have been audible to us where we sat, nor was there any other clock in that room. After puzzling over this for some time, and struggling to capture my elusive associations, it came to me all at once that the tick-tock of the clock suggested the lūb-dūp of a heartbeat and the purring of the fire the respiratory rustle. In short, my physical conditions were closely reproducing those of the infant clasped by its mother's left arm against her breast in the state of complete satisfaction of the recently well-suckled. Lying so (in the position, it is to be noted, in which a right-handed woman normally carries her child), the mother's apex-beat is in the region of the infant's head. Presently, trying to imagine clearly the baby's experience, I realized that not only would he *hear* this regular and reassuring beat, but he would *feel* it too, a rhythmic thrust against his head.

I think it was not till some days later that it dawned on me that I had stumbled on the explanation of head-rolling and similar movements, such as

rocking on all fours with bumping of the head at the end of each forward thrust: the child was endeavouring to reproduce the conditions of its early bliss. In short, the habit was in every way comparable to thumb-sucking as a method of self-comfort.

Considered from another angle, I also saw, this theory explained too those cases where the habit was patently not a form of auto-erotic satisfaction, but a form of aggression and an expression of fury. When the nursling is angry with the breast itself, or later, angry with a frustrating mother who is claspng him to her breast, this rhythmic thrust ceases to appear as a rocking, soothing movement, an expression of love, and becomes instead an attack. The bad breast is attacking *him*, it is banging his head, and he will bang back in retaliation, struggling to turn in his mother's arms and to batter her with his forehead. When he is older, perhaps between two and three years old, and he is angry with his bad mother or any substitute frustrator, he may seek to attack her (or it) by head-banging of his physical support (now become the floor or furniture instead of his mother's chest and arm), and the pain he suffers in so doing at once becomes her cruel attack on him and hence inflames him further, until he is physically and emotionally exhausted.

It was almost exactly a year later, that is in mid-December, 1949, that I encountered a case which so strikingly bore out this theory I had formed that I have been tempted to publish it. The case-history is as follows:

The patient, a six-year-old boy, John, of average intelligence, was brought to the Child Guidance Clinic with the complaint that "he was nervous, and imitated the sound of doodlebugs all night long while asleep." This child was the third of three boys, but his two elder brothers had been evacuated in 1941 and remained away till 1945, so that from the time of his birth in October, 1943, he had enjoyed the role of only child at home.

During the "doodlebug" raids the boy's mother was extremely frightened (the father was away in the Forces, and she alone in the house with her infant). When the sirens sounded she used to seize John in her arms and rush down the garden to their air-raid shelter, where she would sit on the edge of the bunk clasping the child to her breast (with her left arm), and sometimes rocking to and fro. She never lay down herself, and never put the child down, as long as the "alert" lasted, sometimes sitting up all night. John himself never showed signs of fear. (It is of interest that this child was entirely bottle-fed, and that his mother is right-handed. If my theory is correct, then one might expect to find head-banging, at any rate as a means of self-comfort, more commonly in bottle than in breast-fed babies, since in the case of the former the sound and throb of the mother's heart-beat are invariable accompaniments of suckling, whereas with the breast-fed, these are present during only half their feeding time).

In early July, 1944, this mother became pregnant with her fourth child (a girl), and during the third month of that pregnancy developed "kidney trouble" and was ordered to bed by the doctor, remaining there till two months after the baby's birth at term. About a month after his mother retired to bed John began head-banging while sitting in his high chair, which stood against the wall. The infant used to knock the back of his head against the wall behind him, throwing his head backwards and forwards rhythmically and imitating the sound of the "doodlebugs" the while. About two months later John was evacuated to a Residential Nursery (on account of his mother's ill-health), and remained there six months. On his return he found his baby sister in possession, and about one month after that his two (unknown) brothers returned, so that, from having been virtually the only child, this boy suddenly found himself third in a family of four. The first night after he got home it was discovered that John was still head-banging, but now he was doing it by rocking to and fro on all fours in his cot, bumping his head into the pillow at the end of each forward thrust, and all the time making the

"doodlebug" noise, which much distressed his mother. The child rocked with such energy that he used to move his cot right across the room before he fell asleep, which was often not "for hours." During the day he was over-anxious, clinging to his mother, and prone to temper tantrums when frustrated by his siblings. All his symptoms have gradually improved, and when I first saw the boy the only remaining complaints were of a certain amount of head-rolling on his pillow when he first went to bed at night, still accompanied by the "doodlebug" noise, of a tendency to lose his temper with his siblings, and of slight jealousy of his father (who is a Regular Serviceman), shown by attention-seeking behaviour, described as "showing off," whenever he was at home. (The reason why John was brought to the Clinic at this late date was, of course, that the Assistant School Medical Officer had only just learnt of the complaint from the mother.)

In John's case I think it is clear that the head-banging and its accompanying noise have been fundamentally an attempt on the part of the child to recreate that happiest period in his life, when he and his mother were the only two people in his world, and when she used to hold him clasped in her arms, in his feeding position, for hours at a time, with her heart pounding violently beneath his head (since she herself was very much afraid), while the V.I.'s went by aloft. Nevertheless, even here there seems to have been an element of aggression in the habit. Why did the child change his position while away? I think that on first finding himself torn from his home, his longing for the comfort and consolation of his mother's arms was so great that on being put to bed and visualizing himself once more with her, he was impelled to turn to throw his arms about her, only to find her still not there. In fresh distress he would begin bumping his forehead on the pillow once more, but now there would be anger at her absence, her cruel desertion, as well as grief and longing to be relieved by the movement. To enable himself to use more force, the child would have to rise on his hands and knees, and this, in fact, is what John did. The rocking and banging then served not only to produce the illusion that the mother was present, since he seemed to feel her breast beating against his forehead, but to express his rage against her too, so making a perfect gesture of ambivalence.

Finally, after John had been home again some time, and when he had made considerable adjustment to his siblings and father and had begun to regain a certain degree of security, he changed his position once more. He ceased to turn on to his face, but lay on his back, as at first, and simply rolled his head from side to side on the pillow without any banging, though he still made his magic, evocative noise. I think the boy has begun to forgive his mother.

I would like to express my thanks to Dr. A. Elliott, County Medical Officer of Kent, for his permission to use this case-material from the Chatham Child Guidance Clinic.

CHANGES CONTINUING AFTER THE TERMINATION OF TREATMENT OF MENTAL DEFECTIVES WITH ANEURIN

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HARRELL (1943, 1946), working with children in an orphanage, reported that improvement during administration of aneurin continued during the year following cessation of the treatment. The improvement which continued occurred in intelligence tests, educational achievement, reaction time, and height and weight gains.

In previous articles (Rudolf, 1949, 1950(1)) accounts have been given of the results of the treatment of mental defectives with aneurin over periods of 6 and 12 months. This article describes changes continuing after cessation of the treatment of 24 mental defectives who showed improvement at the ends of both the 6 and 12 months' courses. Table I shows the number who improved after the cessation of treatment in one of the four aspects of behaviour in the lodge, at school or at work, in social age or in intelligence quotient. The table shows that each patient continued to improve in one aspect only, the total number of cases in (b) being equal to the sum of the number of improvements.

TABLE I.—*Number of Cases Showing Continued Improvement up to One Year after Cessation of Treatment.*

				Behaviour.	School or work.	S.A.	I.Q.	Number of cases.				
(a)	.	.	.	5	.	6	.	15	.	6	.	24
(b)	.	.	.	"	.	2	.	7	.	2	.	13

(a) = Number of improvements after 6 and 12 months' treatment.

(b) = " " continuing for at least one year after termination of treatment.

Table II gives the social ages and social quotients of the 7 cases who improved in these measurements. It also shows that continuing improvement is not related to epilepsy, 3 epileptics and 4 non-epileptics improving. These figures resemble the proportions of 10 epileptics and 14 non-epileptics in the whole series.

Summation of the social quotients, although statistically unwarranted as each patient is a separate unit, shows clearly the total increase in the social quotients during and after treatment.

TABLE II.—*Increase in S.A. and S.Q. (in brackets) Continuing after Termination of Treatment. Examinations under A and B at approximately 6-monthly intervals in each case; under C at from 1 to 10 months.*

Case number.	A.			B.		C.			
	·94(8·5)	·94(8·5)		1·2(10·0)	·9(7·5)	1·3(10·0)	1·47(11·4)	1·24(8·8)	
	1·5(12·5)	1·3(10·8)		1·8(13·8)	1·8(13·8)	2·1(15·0)	2·2(15·7)	1·83(11·6)	1·83(11·6)
E.P.	1·77(11·8)	1·77(11·1)	1·77(10·4)	1·83(10·8)	1·89(11·1)	2·0(11·1)	2·1(11·5)	2·2(11·6)	
E.P.	1·94(8·3)	1·94(8·1)	1·94(7·8)	2·8(11·2)	3·2(12·1)	4·0(16·0)	4·0(16·0)	3·7(14·8)	
	2·9(29·0)	2·9(29·0)		3·4(30·9)	3·4(30·9)	4·7(39·2)	4·7(39·2)	4·7(36·1)	4·7(36·1)
	3·0(50·0)	3·0(50·0)		3·2(45·7)	3·2(45·7)	3·7(46·3)	4·5(56·3)	5·2(57·8)	4·2(46·7)
E.P.	4·3(33·3)	4·3(33·3)		5·2(37·1)	5·2(37·1)	5·4(36·0)	6·0(40·0)	8·3(51·9)	7·8(48·8)
named	153·4	150·8		159·5	158·2	173·6	190·1	192·6	

A = Before and at commencement of treatment.

B = During and at end of treatment.

C = After termination of treatment.

Table III shows that the maximum S.A. and the maximum S.Q. before treatment were lower than those after its cessation. Each case was examined on at least two occasions, both before the commencement of the treatment and after its termination.

TABLE III.—*Maximum Social Age and Social Quotient Before and After Treatment.*

Case number.	Max. S.A.			Max. S.Q.	
	Before.	After.		Before.	After.
29	·9	1·5	·	8·5	11·4
25	1·5	2·2	·	12·5	15·7
56	1·8	2·2	·	11·8	11·6
42	1·9	4·0	·	8·3	16·0
68	2·9	4·7	·	29·0	39·2
36	3·0	5·2	·	50·0	57·8
74	4·3	8·3	·	33·3	51·9

The improvements in intelligence quotients were of a slight degree only. Case 60 gave quotients of 21, 27 and 30, and Case 73 of 24, 23 and 28, the last figure in each instance being recorded after the cessation of treatment.

DISCUSSION.

In a recent paper (Rudolf (2), 1950) an improvement-rate of 82·8 per cent. was recorded in a mental deficiency hospital when 540 defectives of both sexes, all ages and all grades, were reviewed. The cases selected from hospital for treatment with aneurin were those who had been in-patients for at least three years and had shown no improvement for at least one year before the beginning of the treatment. Any improvement would, in consequence, be of interest. Epilepsy appeared to have no effect upon the results.

The continuation of improvement after the termination of the treatment is comparable with the continuation of over-activity after cessation of the treat-

ment. In a previous article (Rudolf,(1) 1950) evidence was given, based on 14 cases, that a period of from 2 weeks to 3 months passed before over-activity, associated with the administration of aneurin, ceased. Cases 25, 42, 36 and 74 in Table II suggest that the vitamin is stored, or exerts an effect, for a period greater than 3, and perhaps up to 14 months in duration, as the social quotients did not begin to decrease until at least one year after cessation of the treatment.

My thanks are again due to Dr. J. Lyons for his interest in this work.

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THE GALACTOSE TOLERANCE TEST IN PHENYLKETONURIA.

By VALERIE A. COWIE, M.B., Ch.B.

From the Fountain Hospital, Tooting Grove, S.W.17.

[Received 14 March, 1950.]

IN cases where there is known to be a disturbance of metabolism it is natural to speculate upon the possible site of dysfunction in the organs and tissues of the body.

In phenylketonuria the basic biochemical error is a disordered metabolism of phenylalanine, the patient being unable to dispose of this substance at a normal rate (Jervis *et al.*, 1940). The phenylpyruvic acid in the urine of phenylketonuric patients is derived from a deamination of phenylalanine in the kidney.

Jervis and his co-workers (1940) put forward evidence to show that the normal route of phenylalanine catabolism passes through tyrosine. This conversion appears to be the stage at which the block occurs in the metabolic system in phenylketonuria.

Jervis (1947) showed that the intravenous administration of phenylalanine to rabbits is followed by an increase of a tyrosine-like substance in the blood, indicating that the conversion of phenylalanine was not due to changes occurring in the intestinal tract.

Embsden and Baldes (1913) showed that when the liver is perfused with phenylalanine, tyrosine is found in the perfusion fluid. This points to the liver as being one possible site of dysfunction in phenylketonuria.

The findings of only two post-mortem examinations on phenylketonuric patients have been published. In the first (Penrose, 1939) it is stated that the liver appeared normal. In the second, reported by Coquet *et al.* (1944), perilobular fatty degeneration and stasis in the intratrabecular capillaries were noted.

Delay *et al.* (1947), in a discussion of the pathogenesis of phenylketonuria, mention the extrapyramidal signs and choreoathetotic movements observed in phenylketonuria, Kinnier-Wilson's disease and in the pseudosclerosis of Westphal-Strümpell. In the latter two diseases hepatic lesions exist, and Delay and his co-workers point out that it is not without interest to compare these lesions with those found in the liver in the post-mortem examination of the phenylketonuric patient reported by Coquet *et al.*

In the same paper (Delay *et al.*, 1947) it is stated that the galactose tolerance test performed on a phenylketonuric patient gave a result similar to that found in acute hepatitis.

The present writer has carried out galactose tolerance tests for liver function on 12 phenylketonuric patients at the Fountain Hospital. In this test 40 gm.

of galactose are given orally to a fasting patient. An excretion of 0 to 3 gm. of galactose in the urine in the following five hours is within normal limits. In none of the cases was more than 2.87 gm. of galactose excreted in the urine in the five hours following ingestion. The results obtained are given in the accompanying table.

COMMENT.

In the galactose tolerance test, excretion of over 3 gm. of galactose during the five hours following ingestion is considered a decreased tolerance and indicates diffuse degeneration or damage of the liver by infection or by toxins (Shay, 1931). A decreased galactose tolerance is commonly accepted as being indicative of gross liver damage. The results obtained in the 12 cases of phenylketonuria under consideration exclude the presence of any pathological condition of the liver demonstrable by this test.

Patient.	Sex.	Age.		Mental level.	Amount excreted in five hours after ingestion. Gm.
P.—P.	Female	20 yrs.	2 mths.	Idiot	0.55
I.—S.	„	12 „	9 „	„	0.79
L.—B.	„	18 „	8 „	„	0.82
J.—S.	„	21 „	9 „	„	0.87
F.—W.	Male	6 „	4 „	„	0.96
C.—B.	Female	6 „	9 „	„	0.96
P.—Pa.	„	4 „	6 „	„	1.05
B.—C.	Male	8 „	11 „	„	1.24
D.—T.	„	14 „	10 „	Imbecile	1.75
J.—R.	„	7 „	9 „	Dull and backward	1.89
A.—J.	„	9 „	9 „	Idiot	2.69
F.—T.	Female	7 „	8 „	„	2.87

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Part II.—Reviews.

Neurological Anatomy in Relation to Clinical Medicine. By A. BRODAL.
Oxford: Clarendon Press, 1948. Pp. 496, with 94 illustrations. Price 42s.

Postgraduate students of clinical neurology or of neurological anatomy will find their needs met in a very satisfying, one might say, unique way in this excellent book. Dr. Brodal is fully alive to the special interests of clinicians and the problems confronting them, and his detailed review of selected aspects of the structure of the nervous system is admirably designed to provide the necessary anatomical background for their studies. Much of the information set out in these pages has hitherto been available only in special journals, and the serious student will be saved an immense amount of time-consuming library work by Dr. Brodal's masterly compilation. The bibliography runs to thirty pages, the majority of the contributions quoted being in English and covering the subject up to about 1945. Thus, as a work of reference alone the book is well worth having. Where all is good it is difficult to select any single feature for praise, but it seemed to the reviewer that the long section on the cranial nerves was remarkable for its lucidity and comprehensiveness.

Here is a new standard work of the greatest value to all workers in the wide field of human neurology.

R. M. NORMAN.

The Biology of Mental Defect. By LIONEL S. PENROSE, M.A., M.D.
London: Sidgwick and Jackson. Pp. 285. Price 21s.

Mental deficiency workers in this country owe a great deal to Professor Penrose, whose researches have done so much to give scientific respectability to their speciality. It is, then, a matter for rejoicing that after the hiatus of the war years Professor Penrose has returned with apparently undiminished interest in the problems of mental subnormality. This book is a much more substantial contribution to the subject than was his first, which appeared in 1933. The practical experience gained by the Colchester survey, the findings of which are extensively quoted here, combined with the author's deep study of genetic principles, give the stamp of authority to a book which will instruct and stimulate a wide circle of students of mental deficiency. The early chapters are concerned mainly with the historical background, discussion of the definition and incidence of mental defect and the measurement of intelligence. Principles of classification and of causation are then considered, and a chapter on methods analysis in human genetics is interpolated. A short account of the inheritance of intelligence and the action of differential fertility is followed by chapters of a more exclusively medical nature dealing with rare dominant and recessive defects, malformations, environmentally determined disabilities, mental disorders and treatment. It was not, perhaps, to be expected that a single author could survey so wide a field with uniform perspicacity, and one is not surprised to find Professor Penrose more at home in the statistical and genetical sections than in the clinical ones. Many may think, indeed, that his chapter on methods of analysis in human genetics is too recondite for the majority of his readers, while at the same time being rather *vieux jeu* to the genetic specialist. On the other hand, a criticism of a different sort suggests itself in connection with the chapter on treatment. Here it may

well be thought strange that the Galton professor finds so little to say about the contribution to be expected from a programme of positive genetics in reducing the incidence of high-grade defect or dullness in the general population. Throughout the book a very liberal estimate of the effects of environment upon intelligence has been put before the reader, yet even Professor Penrose does not suggest that the variance of I.Q. is less than 50 per cent. genetic. It might, therefore, be supposed that selection would be an influential factor and, indeed, a fairly rapidly effective one in improving the intelligence of a race. This consideration, however, is not taken into account.

The precision of the statistician is not always in evidence when the author turns to clinical or pathological themes, and here not a few puzzling lapses have been noted. The phrase, "the putamen of the thalamus," on page 152 obviously needs correction. It is surprising, also, to read of Niemann-Pick's disease as having its onset in adult life and being inherited as a dominant. Some of Professor Penrose's clinical asides, no doubt intended for non-medical readers, certainly lack the vivid touch of the born teacher. It would be difficult, for instance, to form an accurate mental picture of an oculogyric crisis from its description as a "transitory inability to move the eyes or eyelids." It is erroneous to write of a "dull red spot" at the macula as a typical feature of juvenile amaurotic family idiocy, and one would like to know the justification for the statement that in Tay-Sachs' disease the degenerative process strikes first at the nerve cells of the pyramidal system before other parts of the cortex become involved. It also seems to the reviewer to be misleading that the Pelizaeus-Merzbacher disease should be simply designated as "a degenerative condition affecting the pyramidal tracts," when its essential pathological feature is, of course, a widespread demyelination of the hemispheric white matter.

It would, however, give a wrong impression of this very worth-while book to multiply such instances of inaccuracy or careless compilation, which will, no doubt, be rectified in a later edition. Let us rather welcome it as a thought-provoking commentary, by one of our most distinguished research workers, upon the many important present-day problems of mental deficiency—that still so neglected and little-understood branch of social psychiatry.

R. M. NORMAN.

Psycho-therapeutische Studien. By ERNST KRETSCHMER. Stuttgart: Georg Thieme, Verlag, 1949.

These studies are a collection of lectures and occasional papers somewhat artificially arranged under a few headings and commended by the author as a book of personal experience. It is written in the pleasing and persuasive style for which Kretschmer's works are renowned, makes smooth reading, but little attempt at serious penetration of its problems. If Kretschmer speaks of "depth person" or "depth psychology," he means somatic mechanisms, physiology and pathology, into which he changes over from the psychological field quite unconcernedly. In fact, he makes the plea that preciseness in theory and adequate concepts allow such bridging of the psycho-physical gap with the greatest ease. Psychotherapy is dealt with from the point of view of the extravert psychiatrist, for whom the human instincts are bound to balance themselves out in the end and chime in with the harmony observed in nature everywhere. Harmony with one's own nature is the aim, respect before the social order, modesty and awe before religion are the requisites of psychotherapy. This optimistic realism is also expressed in Kretschmer's ideal of the harmonious personality which he finds in the French aristocrat of the seventeenth and eighteenth century! No wonder that there is no love lost between him and Freud. He pays the usual decorous lip service to his genius, makes free use of analytical concepts, but dismisses the pansexual

theories of the Freud-"epigones" as a reaction formation against the prudery of the Victorian age.

W. MAYER-GROSS.

Mr. Carlyle, My Patient: A Psychosomatic Biography. By JAMES L. HALLIDAY. London: William Heinemann Medical Books Limited, 1949. Price 15s.

Thomas Carlyle (1795-1881) was the son of a stonemason who lived and worked in the small Dumfriesshire town of Ecclefechan. The stonemason was a hard man who inspired awe and repelled affection; his wife was an anxious, religious, almost illiterate woman of modest understanding who underwent a brief psychosis about the involuntal epoch. Early in life Carlyle showed evidence of unusual intelligence, and when he was 14 years old he was enrolled at Edinburgh University, walking the 100 miles from his home over a period of five days. It was not until he had given up some years to teaching and had attained the age of 26 that he began to devote himself to literature, and he was middle-aged before he had any freedom from financial anxieties.

From lowly beginnings and from an undistinguished family stock, after years of striving, he raised himself to international eminence as a thinker and writer. He was honoured not only in Europe and in America, but even in his native land. Throughout his long life the ties that united him to his family were never broken, and his innumerable letters reveal his tender, affectionate and generous thoughts.

When he was 23 he began to suffer from abdominal pains and insomnia, whilst his always irritable temperament became more marked. He was a moody man, and his marriage to Jane Welsh, herself a writer and conversationalist of wit and intelligence, was never a pattern of felicity. Single-minded in the pursuit of his profession, he never observed his wife's sufferings and frustrations during the time that she was alive, and yet these two people, each a difficult individualist, achieved productive and cultured lives together.

What concerns us here, however, is the nature of Carlyle's symptoms. That they were without organic basis is reasonably certain, and the total clinical picture is of a psychosomatic disorder occurring in the abnormal personality of a genius. Is it necessary or profitable for the explanation of these symptoms to look beyond an abnormal constitution, a repressive and repressed father, an anxiety-ridden mother, and financial hardships?

Dr. Halliday, who has apparently been recently received into the Freudian fold, believes that further interpretation is necessary. His "psychosomatic biography" is primarily intended for the general public, and he aims to disarm criticism by disclaiming any attempt to explain the Sage of Ecclefechan, even though the psychosomatic approach implies that the total individual is studied. The laity will receive from this book the erroneous impression, recently current in other quarters, that all psychosomatic and psychological medicine is based on psychoanalysis.

The book assumes that, no organic disorder having been found in Carlyle's case, he has been referred for further opinion to a psychiatrist in the person of Dr. Halliday. From the mass of Carlyle's writings, and after he has put in some ingenious work on his material, Dr. Halliday laboriously and triumphantly extracts evidence of the too-familiar Oedipal hates and loves. By an incontinent use of psychoanalytical concepts, especially anal ones, Carlyle's disorders and, indeed, the literary products of his genius are traced to infantile insecurity and libidinal fixations. Sir Richard Quain, who had the advantage of being able to examine Carlyle, attributed the dyspepsia to "a very nasty gingerbread." The modern reader will find this etiology unsatisfactory and fanciful, but he may have the same criticism against Dr. Halliday's Freudian interpretation.

The Victorian era with its repressive patriarchs and sexual inhibitions

is the age *par excellence* for unearthing Freudian dynamisms, and when are added the repressive forces of a narrow Lowland Scottish upbringing, it may be agreed that if anyone is to offer evidence in favour of psychoanalysis, then Carlyle is as suitable as many Victorians. Of all this Dr. Halliday is very well aware, and with the enthusiasm of the recently converted he is indefatigable in his moulding and interpretation of the events in Carlyle's life so that they may fit in with his pre-determined theories.

In the first page of the book Carlyle is quoted as having written, "It was the earliest terror of my childhood that I might lose my mother, and it had gone with me all my days." By mental processes which cleverly dispense with certain intermediary steps of logic, Dr. Halliday suggests that "the persistence of terror at the feeling of losing his mother may, therefore, have been the outcome of deep-seated feelings of guilt arising from and associated with early hostile impulses directed against her. So much for surmise." But it is not 'so much for surmise,' because such speculations, with no more basis, continue throughout the book. The same mental processes, or perhaps references to some handy little table of symbols carried by every fledgling Freudian, illumine the following extract. Carlyle described his earliest memory as "backwards beyond all, are dim ruddy images, of deeper and deeper brown shade into the dark beginnings of being." Dr. Halliday's interpretation is that ruddy images suggest uncontrollable anger, i.e. seeing red, and the deepening brown shades into which they merge suggest the colour ranges of faeces. They also suggest the colour ranges of gingerbread, but this latter possibility is not pursued.

Again, Carlyle describes an incident from his childhood, when he gave fourpence to a crippled beggarman. "Never in all my life did I feel anything so like Heaven as the pity I had for that man. I would give £100 now to have that feeling back again for one moment." Oddly enough, Dr. Halliday regards the use of the word "pity" as itself odd, and at once concludes that in Carlyle's case pity included a large element both of sadism when it is related to others, and of masochism when it related to himself.

Again, Carlyle described his schoolmaster as a man who was "always merry and kind to me though, to the undeserving, severe," and from this evidence alone Dr. Halliday concludes that what Carlyle really experienced as "merry" was the sadistic excitement induced in him when he witnessed the teacher give physical chastisement to the "bad boys" who so clearly deserved what they got. It would at this point be an interesting exercise, albeit a tactless one, to examine just why Dr. Halliday regards his patient with such loathing. The doctor-patient relationship in this case is without warmth, humanity or humour, and the physician is to be congratulated on having avoided the dangers of an undissolved positive transference. The filial and fraternal tenderness that pervaded Carlyle's life and letters never emerge from Dr. Halliday's interviews. Without comment one may aptly quote Carlyle's first biographer who wrote, "When the Devil's advocate has said his worst against Carlyle, he leaves a figure still of unblemished integrity, purity, loftiness of purpose, and inflexible resolution to do right, as of a man living consciously under his Maker's eye, and with his thoughts fixed on the account which he would have to render of his talents."

Dr. Halliday's book does no service to psychiatry. He has undoubtedly proved his case that Carlyle's symptoms were functional and psychogenic in origin and nature; indeed, this conclusion is obvious, but he has failed to prove that the psychoanalytical, as distinct from the psychosomatic approach, has validity. The man-in-the-street, when he contemplates the dismal ruins into which crumbles a man of genius when psychoanalysts have done with him, may well feel some apprehension (obviously from infantile insecurity but none the less real) when he is referred for a psychiatric interview.

HUNTER GILLIES.

A Psychiatrist Looks at Tuberculosis. By ERIC WITTKOWER, M.D.

Dr. Wittkower, who, as Dr. Rickman remarks in his introduction to this book, "has worked on more psychosomatic problems than any other research worker, and in each case made notable contributions," was bound to tackle one day the time-honoured puzzle of the mentality of the consumptive. When the National Association for the Prevention of Tuberculosis provided him with the opportunity, he attacked the problem in his own way, interviewing 785 patients in sanatoria, dispensaries, clinics and in their homes, each for several hours. The present small volume, written in non-technical language—except for a few paragraphs in the third chapter dealing with Freudian psychodynamics—is addressed to all workers in the field of tuberculosis, and should do much to bring home to them the importance of the psychological approach to the patient. Wittkower's detailed and striking observations, and the remarks he collected from the patient's tales, illustrate very well the peculiarities of tuberculous patients, which is not difficult to understand. Most of it can, according to Wittkower, be explained as reaction to the situation of being physically handicapped for an indefinite period in the prime of life, with an uncertain outcome by an infectious illness with a social stigma.

While the first two chapters, dealing with all the practical problems, will be a welcome source of information and enlightenment to all concerned, the aetiological relevance of emotional factors is the subject of the third and last chapter of the book. Wittkower is anxious not to disagree with certain tuberculosis specialists, who have no doubt over-stressed this intricate question lately. From 300 cases closely examined for the assessment of their premorbid personality, he derived four main types: the overtly insecure, the rebellious, the self-drivers, and the conflict-harassed type. Their varied reactions to the illness situation is described and analysed, but, as one would expect, a common factor related to the physical disease was difficult to discover. With many reservations and provisos, pointing out especially the unfortunate lack of any comparative or control series, Wittkower advances a psychopathological hypothesis of tuberculosis: an inordinate need for affection is a common feature of the pre-morbid personality; situations which rouse aggressiveness or endanger the patient's delicately poised security system often precede the onset of symptoms. "In brief, individuals who develop tuberculosis seem to have in common an inability to deal adequately with their aggressive impulses and are prone . . . to turn them against themselves." "The psychological mechanisms identified here . . . offer some explanation why the patient falls ill . . . but they fail to explain why he falls ill with pulmonary tuberculosis." The answer to this is the usual couplet of all psychoanalytical writings: it can only be found by research on a much deeper level.

W. MAYER-GROSS.

Part III.—Bibliography and Epitome.*

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* A number of abstracts in this section are reproduced from *Chemical Abstracts* and *Psychological Abstracts*. To the Editors of these Journals we extend our grateful thanks.

A Study of the Effect of Evipan on the Flicker Fusion Intensity in Brain Injuries.

The results of all the investigations with the evipan test in brain injuries of various genesis (acute traumas, virus infections, intoxications, active chronic processes) can be summarized as follows:

The evipan test is positive in active, extensive, diffuse brain injuries; the evipan test can probably yield valuable information with regard to the degree of severity of acute traumatic, toxic, and infectious brain injuries and of the activity of chronic pathological cerebral processes.

(Author's abstr.)

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Thyroid Function in Mental Disease Measured with Radioactive Iodine, I¹³¹.

This is a report of a study in progress on thyroid function in patients with mental disease, and in controls, as measured by the uptake of the radioactive isotope of iodine, I^{131} , by the thyroid gland, and compared with serum protein-bound iodine, basal metabolic rate, and plasma cholesterol. These 4 tests represent a combination of the best and most widely accepted methods for evaluating thyroid status known to-day.

Data are given on 36 subjects, 24 patients and 12 controls, and include a total of 61 basal metabolic rates, 66 plasma cholesterols, 65 serum protein-bound iodines, and 78 I^{131} uptake determinations. The largest diagnostic category studied is schizophrenia. The number of patients in all other categories is insufficient to establish any trends.

The average basal metabolic rates are somewhat low in the authors' subjects, the average plasma cholesterols somewhat high. The serum protein-bound iodines fall compactly within the normal range. The uptake of I^{131} is widely distributed, with uptakes below 10 per cent. and above 40 per cent. in several cases but, with the exception of one patient with an uptake of 60 per cent., they fall for the most part within the normal range. In no case did the uptake curves on the authors' subjects resemble the types found in myxedema or thyrotoxicosis. Most important, so far no significant difference has been found between patients and controls by clinical evaluation, and as measured by both old indirect and new direct tests of thyroid function.

The authors' results contrast with many reports in the past of low basal metabolic rate compared with normal controls, and of low plasma cholesterol in schizophrenic patients. Perhaps their more nearly normal findings are due to selection of a group for study with short duration of illness and short length of hospitalization. The significance of reports in the past on patients chronically ill and hospitalized for prolonged periods is open to question. On the other hand, the number of subjects they have studied, particularly control subjects, is still small, and it may or may not be that when a larger sample has been accumulated there will be a shift in trends.

The authors find no change in thyroid function as measured by the above tests in patients during or after insulin shock, electroshock, combined shock, or psychotherapy. Thyroid medication, however, produced profound alterations in findings on all 4 tests in the 2 patients on whom study has been completed.

It should be pointed out that there has been insufficient analysis of rate of I^{131} uptake; the authors have dealt in this paper primarily with the maximum con-

centration of I^{131} accumulated in the thyroid gland after a test dose. Since the data presented in this paper were analysed, results possibly suggestive of some abnormality have been found on 2 depressed manic-depressive patients. (Both patients had a marked drop in their radioactive iodine uptake curve as they improved during electroshock therapy. One patient had an abnormally high initial uptake, the other a high normal uptake. The rate of uptake in the patient with the high normal curve was markedly delayed.) Studies of this diagnostic category, of anorexia nervosa, and of psychoneurosis, of analysis of varying rates of I^{131} uptake and effects of thyroid medication are being pursued further, and will be reported at a later date. (Authors' abstr.)

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Adrenal Cortical Responses to Stress in Normal Men and in those with Personality Disorders.

1. Six indices of adrenal cortical activation have been compared in groups of normal male subjects and schizophrenic male patients when they were subjected to a variety of stresses. The indices are changes in output of urinary sodium, potassium, uric acid, 17-ketosteroids and neutral reducing lipids, together with changes in the number of circulating lymphocytes. The stresses have been the target ball frustration test, operation of a pursuit meter (each test lasting one hour), the effects on the authors' indices of adrenal cortical extract and of pituitary adrenocorticotrophin.

2. Responses of the authors' 6 adrenal cortical indices and also eosinophile responses to injected adrenocorticotrophin were determined for groups of male and female psychoneurotic patients and compared to normal controls.

3. The tests all involved significant numbers of patients and controls, and the results have been treated statistically.

4. The authors' data indicate a highly significant failure of normal adrenal stress responses in the schizophrenic population as compared with the control population.

5. The failure occurs principally at the level of the ability of the adrenal cortex to respond to adrenocorticotrophin.

6. This failure was not corrected by a dietary supplement rich in proteins and vitamins.

7. These findings are discussed in relation to the etiology of schizophrenia.

8. Psychoneurotic patients, in contrast to schizophrenics, respond in a normal fashion to injected adrenocorticotrophin. (Authors' abstr.)

Carbohydrate and Lymphoid Studies in Schizophrenia.

A series of studies have been carried out in schizophrenic patients and normal controls that indicate that (1) there is a reduction of tolerance to glucose in this psychosis; (2) the response of the adrenal cortex to stimulation by the ingestion of glucose is generally deficient, as exemplified by measurements of various blood and urinary variables known to be pertinent to adreno-cortical activation. (Authors' abstr.)

Studies of Adrenal Cortical Activity in Psychoneurotic Subjects.

The use of a cumulative index of adrenal cortical activity has been described.

This has been applied to the estimation of adreno-cortical activity after (1) small doses of A.C.T.H. in anxiety states, (2) injection of saline and venipuncture, (3) controlled thermal pain, and (4) electro-convulsive therapy.

In all these experiments the data indicate activation of the adrenal cortex.

It is suggested that the greater the patient's anxiety and tenseness the greater the activation of the adrenal cortex by the test situation.

The use of pretreatment sodium amytal seems to decrease the response of the adrenal cortex to E.C.T. (Authors' abstr.)

Hallucination and Imagery Induced by Mescaline.

Mescaline produces altered visual experiences of several types, whose vividness and degree of distortion is proportionate to the size of the dose. There are no sharp boundaries dividing abnormal sensibility, illusions, and hallucinations. Subjects who gave fewer responses of the type "I see it," when asked to imagine situations were more likely to hallucinate than other patients. Visual responses declined still further after administration of mescaline in a degree more closely related to the amount of drug given than to the vividness of hallucinatory alterations, even in those experimental subjects who reported virtually no alteration in actual vision. The fall in reported visual imagery was not found in control subjects.

(Authors' abstr.)

Cytochrome C: Effects of Intravenous Administration in Presenile, Senile and Arteriosclerotic Cerebral States.

Theoretically and experimentally the vital role played in cellular metabolism by the cytochromes as respiratory tissue enzymes is recognized and appreciated (14). This apparently also applies to tissue activity in the nervous system, particularly during growth, differentiation, and regeneration following injury. Cytochrome C, a commercially available preparation, was selected for clinical trial in cases of presenile and senile states, with or without evidence for nervous system arteriosclerosis. The authors fully recognize that there are other equally important enzyme systems involved in cellular metabolism, notably riboflavin or flavoproteins and pyridine nucleotides. The latter has the important nicotinic acid amide component serving as a reversible hydrogen acceptor, and is indispensable for the action of a great many dehydrogenases. However, catalytic action of Cytochrome C is still a link in part of the oxidation going on through these systems. The relation of cellular oxidations to lipid phosphorylation is also thought to be through oxidations by the cytochrome system (11). Cytochrome C, therefore, seemed to be a good choice for trial (15, 16).

Clinical improvement was noted in a majority of cases observed in regard to memory, orientation, irritability, interest, confusion and behavior. Only slight changes were observed in the electroencephalographic recordings, and these changes may be insignificant. Psychometric examination showed qualitative improvement in keeping with clinical improvement and a trend toward higher scores.

The changes noted in these patients during the trial period are quite in contrast to the results obtained in the problem of treatment of the senile states for the previous 3 years on the psychiatric service. During that period 27 cases were diagnosed as senile reactions. Of these, 6 were improved and, of these 6 cases, 4 were treated with electro-shock. The remaining 21 cases were referred to State institutions, domiciliaries, nursing homes, or sent home as unimproved. These cases were given the routine supplementary vitamin therapy, symptomatic care, special diets, and routine activity programs which were also part of the program for the cases reported.

Total duration of mental illness, as judged by reviewing the literature, in the senile psychotic state tends to be from 1 to 3 years, generally less than 2 years, and when improvement takes place it most generally does so within 2 or 3 months' time. Because of the heavier and increasing burden to mental hospitals, any aid to hasten possible improvement and the care of the aged seems justifiable when psychological and physical factors combine to incapacitate the individual.

The authors wish merely to report these studies as observations, making no

claims beyond the theoretical about specific action or changes produced by this enzyme. They feel encouraged, though, by the clinical changes noted during the short observation period. The biochemist can give the authors little help in interpreting these observations beyond theoretical speculation, but neither can they tell them what happens to cellular metabolic processes in nervous tissue as a result of electro-shock or insulin therapy. The authors, nevertheless, use such therapy because it works. The pharmacologists express themselves freely that the role of cytochrome in cellular respiration is well established, but they are very sceptical that injected cytochrome can be utilized as such by the body tissues. However, practically no work has been supplied by either the pharmacologists, the experimental biologists or pathologists that would indicate Cytochrome C to be of any utility in the therapy of pathological tissue states such as those in which we are interested.

More promising and encouraging are apparent results from Cytochrome C, noted by the authors in their trial of it in acute toxic inflammatory reactions of the nervous system, about which they hope to report separately at a later date.

(Authors' abstr.)

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*Frontal Lobotomy and Electrical Stimulation of Orbital Surface of the Frontal Lobes :
 Effect on Respiration and on Blood Pressure in Man.*

The effect of lesions and of stimulation of the frontal lobes in man on respirations and on blood pressure was studied in 19 psychiatric patients. The effect of frontal lobotomy on blood pressure was noted in 10 patients. The effect of transcortical electrical stimulation of the orbital surface of the frontal lobes on blood pressure and respirations was observed in 9 patients. The results may be summarized as follows :

1. There was no consistent change in blood-pressure levels after frontal lobotomy, several patients being followed up for one year after operation.

2. Electrical stimulation of the orbital surface of the frontal lobes produced an elevation of blood pressure in 6 of 9 patients and a cessation or diminution of respirations in expiration in 7 of 9 patients. These responses occurred together during a given stimulus in 2 patients. In 4 patients elevation of blood pressure occurred independently of a change in respirations. In 5 of 7 patients the changes in respirations were independent of a change in blood pressure during a given stimulus.

3. While the magnitude of elevation of blood pressure was not striking, the average elevation for the 6 patients was 3.5 times as great as the maximal spontaneous variation for the systolic blood pressure, and 3.4 times as great as the maximal spontaneous variation for the diastolic blood pressure.

4. The authors' crude method of identifying the stimulus area did not permit them to be certain of the location of the responses. The responsive areas appeared to be along the posterior orbital aspect of the orbital surface. These findings confirm for the first time in man the results of animal studies.

The significance of these observations as regards the cortical control or regulation of blood pressure or respiration will have to await more precise studies of the anatomy and physiology of these areas. (Authors' abstr.)

Psychiatric Aspects of Vagotomy. IV. Phantom Ulcer Pain.

Psychiatric studies of patients with peptic ulcer treated by vagotomy revealed that one of the sequelae of this operation is a syndrome characterized by the persistence of symptoms of ulcer, in spite of roentgenologic evidence of healing of the lesion.

The hypothesis is proposed that the persistence of ulcer pain in such circumstances represents a phantom sensation ("visceral phantom pain").

In support of this hypothesis certain clinical and theoretic data are presented. It is suggested that in certain circumstances a visceral lesion, such as peptic ulcer, may become part of the patient's body image. An organic procedure which then leads to the disappearance of the lesion may thus be followed by the appearance of phantom sensations, in this instance, phantom pain simulating "ulcer pain." Psychologic factors which may predispose to the development of this syndrome are briefly discussed. (Author's abstr.)

Longevity in Multiple Sclerosis.

It is noted that in these 3 cases of long duration the multiple sclerosis was primarily of the spinal type for the greater part of the course. In all 3 cases manifestations of the disease remained limited chiefly to the spinal cord for about twenty years. Although the so-called spinal type bears a good prognosis, eventual dissemination throughout the neuraxis can be expected. (Authors' abstr.)

Blood Chemistry of Schizophrenic Patients Before, During and After Insulin Shock Therapy: Preliminary Studies.

Blood chemistry determinations were performed on 24 young men with schizophrenia before, during and after insulin shock therapy. The results are summarized as follows:

1. Values for serum potassium, sodium, chlorides and magnesium and blood levels of glucose and total reducing substances were normal before and after insulin therapy. The glucose and total reducing substances of the blood were sharply reduced during coma.

2. The lactic acid levels of the blood were variable, being either low or high in a few cases before and after insulin treatment. Pyruvic acid was essentially normal. The lactic acid-pyruvic acid ratio had a wide range.

3. Of the phosphate fractions, serum inorganic phosphorus was generally increased before and after treatment. Blood inorganic phosphorus was increased in a few patients before treatment, but was normal in all patients after treatment. Values for adenosine triphosphate phosphorus after treatment were higher than the values before treatment, many of which were below normal. The total organic acid-soluble phosphorus was somewhat increased after treatment, many of the pretreatment results being below normal. Hexose phosphate phosphorus levels were variable, and were essentially the same before and after treatment. Diphosphoglyceric acid phosphorus was normal before and after treatment. The only phosphate fractions to show a significant change during deep coma were the inorganic phosphorus of the blood and serum, which dropped.

4. Of the hepatic function tests performed, the sulfobromophthalein sodium test (with one exception), the alkaline phosphatase determination and the thymol turbidity test all gave normal results before treatment. After treatment the values for the thymol turbidity test were increased in a few cases. The results of the cephalin flocculation test were positive before treatment in several cases, in some of which they became normal after treatment. (Authors' abstr.)

Neurofibromatosis (von Recklinghausen's Disease of the Nervous System): Analysis of the Total Pathological Picture.

The basic lesions are multiple foci of hyperplasia and neoplasia of the supportive or protective derivatives of the ectoderm.

The neuroglia, myelin, meninges, capsule cells and connective tissue of the cerebrospinal ganglia, the supportive tissue of the nerves and the protective and supportive tissue of the epidermis participate in the disease process.

The basic tissue is not exclusively of neural crest origin or of connective-tissue origin, as would be indicated by certain discussions in the literature.

To the protective and supportive elements is frequently added a vascular component, which may occur as independent vascular lesions or as vascularized supportive lesions.

Hyperplasia and tumor formation of parenchymatous elements occur rarely, and are chiefly in the form of chromaffin tumors of the adrenal glands and hyperplastic nerve bundles (neuromatosis).

Neurofibromatosis is related to the other neurocutaneous disorders.

(Author's abstr.)

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Studies on Headache. I. Effects of Carbon Dioxide-Oxygen Mixtures Given During Preheadache Phase of the Migraine Attack. II. Further Analysis of the Pain Mechanisms in Headache.

The preheadache phenomena of migraine, visual disturbances, paresthesias and dysarthria are associated with, and probably due to, cranial vasoconstriction. These phenomena can be modified or abolished by certain agents which produce cranial vasodilatation.

A series of patients were given a 10 per cent. carbon dioxide-90 per cent. oxygen mixture by face mask during the preheadache or early headache phase. This mixture abolished the preheadache phenomena and aborted the headache in most of the trials. Ten per cent. carbon dioxide in air was less effective, having a shorter and more transient effect.

There was a lowering of the pain threshold in the intracranial vessels without headache in certain stressful circumstances. The "jolt threshold" was low before and after certain intracranial vascular headaches in a setting of stress and fatigue. After the ingestion of a moderate amount of alcohol, headache could be induced by inverting the subject 60 degrees from the horizontal.

Local vasodilatation of a segment of the temporal artery was produced by iontophoretic application of metacholine chloride and by histamine. Pain was not induced in 64 trials, even though pronounced vasodilatation and edema of the vessel wall were obtained. It is inferred therefore that, in addition to dilatation and edema, other factors are probably necessary for the production of vascular headache of the migraine type.

Certain of the chain of bodily changes leading to migraine headache are evident. Days or hours before the headache there is a change in vascular reactivity followed by vasoconstriction. This is followed by vasodilatation, which is painful, owing in part to a lowering of pain threshold in the vessels. The vasodilatation may be an attempt on the part of the body to restore the homeostasis of cranial circulation.

(Authors' abstr.)

Studies on Headache: Distention of the Rectum, Sigmoid Colon and Bladder as a Source of Headache in Intact Human Subjects.

Headache did not result from experimental distention of the bladder or large bowel in human subjects with intact segmental reflexes. It is inferred that in normal human subjects with constipation or with urinary retention the mechanism of any associated headache is probably not directly related to the visceral distention or to contraction of the large bowel. Moreover, minimally painful distention of the bladder and large bowel in normal human subjects does not result in significant autonomic effects. It is probable, therefore, that the constipation and headache associated with it are not causally related to the distention. (Authors' abstr.)

Histologic Study of the Brains of Monkeys After Experimental Electric Shock.

Five monkeys were given courses of electric shock treatments comparable to those used in human convulsion therapy. An additional monkey served as a control. After the last treatments of the experimental animals all were killed, and the brains fixed by an improved technic of intravascular perfusion and fixation to prevent the development of post-mortem artefacts in the brain and spinal cord.

Histologic study of sections of the central nervous system, stained by precisely controlled neurologic methods, revealed no difference between the experimental and the control animals. There were no neuronal changes, glial proliferation, areas of demyelination or evidence of old or recent hemorrhages in either series. No structural alteration was demonstrated after experimental electric shock.

(Authors' abstr.)

The Current Path in Electric Convulsion Shock.

A brief discussion of mental symptoms occurring with pernicious anemia is given. A review of the available literature showed no case in which electric shock therapy had been used in conjunction with liver therapy.

A case of pernicious anemia with psychotic reaction which was treated with electric shock therapy is reported. Prompt improvement was noted.

(Author's abstr.)

Behavioral and Physiologic Changes Under Stress After Operations on the Frontal Lobes.

In a setting of lowered tension and steadier heart rate, under stress, the patients who had undergone operations on the frontal lobes showed increased responsiveness to external stimulation. These findings support the hypothesis which the present study was designed to test.

Objective evidence of lowered tension after operation was found in the measurement of finger movement and in the measurement of muscle potentials from the neck. Muscular tension and steadiness of heart rate reflect the subject's physiologic state or the setting in which his responses to stimulation occur. Evidence that they may be to some extent an index of what one may call the "anxious set" was presented in a previous paper.

In the present study the increased potency of external stimulation was objectively demonstrated. After operation, withdrawal of the head from heat occurred more frequently, and the magnitude of the galvanic skin response was higher.

Thus, by means of objective behavioral and physiologic determinations, the authors have found differences which parallel the clinical observation that in some cases pathologic anxiety is reduced after operations on the frontal lobes. Moreover, it appears that such a change in psychiatric status may probably be understood in terms of the same formulation which was advanced to account for the observed reduction in intelligence following operative procedures on the frontal lobes.

(Authors' abstr.)

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Results of Spinal Pyramidotomy in the Treatment of the Parkinsonian Syndrome.

The results of spinal pyramidotomy were evaluated in 22 cases of the Parkinsonian syndrome which could be followed for more than 12 months after the operation. The condition immediately after the operation and at the time of the last follow-up examination is described.

Of the various manifestations of the Parkinsonian syndrome, only the alternating tremor could be favourably influenced. In one-third of the cases there was complete disappearance of tremor; in an additional third the tremor was remarkably reduced, and in the last third the results were considered failures.

Reduction of motor strength, present in all cases immediately after the operation, subsided in the majority of cases, but was still demonstrable to a smaller or larger degree in some cases.

This surgical procedure can be considered not a specific treatment of Parkinsonism, but a symptomatic treatment for tremor. Patients have to be selected carefully. The operation can be recommended without restriction to patients with severe distressing alternating tremor if akinetic symptoms and rigidity are not pronounced. In advanced conditions with disabling rigidity and severe tremor the usefulness of the extremities may not be improved by the operation, but the patient usually feels more comfortable after relief from the tremor, even though no more active.

The possibility of the persistence of reduction of motor strength after the operation has to be considered with this operation, as well as other operations for the relief of tremor, but the average disability appears to be less following spinal than following cortical and subcortical operations; there is no danger of convulsions, and there is a substantial difference in mortality in favour of pyramidotomy.

In the present series the results of unilateral operations are presented. The authors have also had favourable experiences with the use of a unilateral pyramidotomy combined with a homolateral cortical operation, as reported by Scott, and also with bilateral pyramidotomies, as first reported by Pimenta. The authors' experiences have been too few and the time interval has been too short to permit definite conclusions concerning the results, beyond the fact that both types of operation are feasible, are not particularly dangerous and promise good results. Ebin's proposal to sever the direct as well as the indirect corticospinal fibres also appears to have merit. (Authors' abstr.)

Experimental Demyelination by Means of Enzymes, Especially the Alpha Toxin of Clostridium Welchii.

Sections or blocks of spinal cord and brain of laboratory animals were incubated in *Cl. welchii* filtrate (consisting principally of alpha toxin), or in various snake venoms, and were then prepared for histologic study. In addition, *Cl. welchii* filtrate was injected intracerebrally into rabbits and intravenously into dogs, rabbits and mice.

In the *in vitro* tests, demyelination, as indicated by the Spielmeyer or the Weil stain, was produced by *Cl. welchii* filtrate, cobra venom and rattlesnake venom.

Fatty degeneration, as shown by the oil red O stain, was found in the cobra venom preparations, but not in the *Cl. welchii* filtrate preparations. Free phosphate ions, as detected by Gomori's phosphatase stain, were found in the *Cl. welchii* filtrate preparations, and a new use for this histochemical technic was introduced. Whereas previously, according to this technic, the presence of an enzyme in a tissue has been detected by the addition of a substrate, in the present modification the presence of a substrate (lecithin) in the tissue is detected by the addition of an enzyme (lecithinase) capable of attacking it.

In the *in vivo* tests the intravenous injections produced no loss of myelin.

It is maintained, therefore, that not only can the myelin sheath be broken down by enzymatic action, but also that it can be broken down in more than one way, that is, that "demyelination" may not always be precisely the same process.

(Authors' abstr.)

Topographic Distribution of Plaques in the Spinal Cord in Multiple Sclerosis.

Spinal plaques have a predilection for a distinct localization. In the posterior columns they always lie in the center, in the lateral columns, in the center and posterior two-thirds, and in the ventral columns, symmetrically on both sides of the anterior median fissure.

The changes begin in the center of the columns, where the diameter of the white matter is greatest. These changes appear around the radial veins. The plaques are of extraordinary length, but small in diameter. As the plaque grows, it first spreads towards the central gray matter, where fusion of plaques from the posterior, lateral and ventral columns takes place. Finally, the lesion reaches the surface of the spinal cord. This mode of progression may be explained by differences in the venous drainage. (Author's abstr.)

Histamine Therapy in Acute Ischemia of the Brain.

Early vasodilatation is considered the logical method of salvaging ischemic areas of the brain.

Histamine phosphate given intravenously in a speed of 0.02 mgm. per minute produces a consistent dilatation of the arterioles, capillaries and venules of the brain.

This is most conveniently accomplished by administering 2.75 mgm. of histamine diphosphate dissolved in 500 c.c. of isotonic fluid and given by intravenous drip over a period of two hours.

No change in the arterial or venous blood pressure occurs in man with this speed of intravenous infusion of histamine.

Histamine infusions were given once to three times daily, and nicotinic acid administered orally to patients with acute ischemia of the brain.

Twenty-five patients have been followed sufficiently long to evaluate the results of such therapy. One death occurred from an intercurrent uremia. Twenty patients had definite improvement in all affected fields, 3 had improvement in some fields, and 2 had no apparent change during histamine therapy.

Compared to the usual mortality and improvement rates without vasodilatation therapy, these results indicate that histamine therapy was of benefit to these patients.

Intravenous infusion of histamine as described is a safe, readily available, and easily administered method of vasodilatation in case of acute ischemia of the brain.

(Author's abstr.)

Changes in Behaviour Following Frontal Lobectomy in Dogs and Cats.

There is a species difference between dogs and cats in the reaction to various stimuli and in general behaviour after removal of the frontal lobes.

The most typical phenomenon observed in dogs after prefrontal or frontal ablation was the "reaction to restraint" without any manifestations of rage.

The intensity of the "reaction to restraint" increased with progressively larger removals of the frontal lobes and with simultaneous ablation of the olfactory bulbs and tracts. This reaction was associated with autonomic hyperactivity, the intensity of which increased in proportion to the amount of frontal brain tissue ablated.

Ablation of a region of the cortex in the dog, corresponding in part to the island of Reil and the orbital surface in man, induced only hyperactivity.

Prefrontal and frontal ablations never produced a rage reaction in cats, but, on the contrary, made them more friendly or indifferent. A more extensive removal of the frontal pole (anterior to the coronal plane through the ansate sulci) abolished the usual reaction to nociceptive stimuli. (Authors' abstr.)

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Study of Efferent Connexions of the Frontal Lobe in the Human Brain after Leucotomy.

1. Brains of patients with a short survival time after leucotomy have been examined with a silver method to trace corticofugal fibres to their termination in subcortical nuclei.
2. After leucotomy lesions restricted to prefrontal areas surprisingly few fibres from the severed areas terminate in the dorsomedial nucleus of the thalamus. Experimental findings asserting that the prefrontal cortex projects to other thalamic or extrapyramidal nuclei are not confirmed for the human brain.
3. When the leucotomy lesions extend into the white matter which underlies dysgranular and agranular cortex of the frontal lobe, terminal degeneration is present in the mammillary body, the dorsomedial and ventrolateral group of nuclei of the thalamus, the globus pallidus, zona incerta, Forel's field, red nucleus and subthalamic nucleus.
4. It has been possible to demonstrate that the cortical fields projecting to these centres are confined to the rostral part of Brodmann's area 6, and to dysgranular areas of the frontal cortex such as Brodmann's areas 8 and posterior 9 (Economo's area FC).
5. Fibres from the frontal cortex which terminate in the mammillary body may represent the anatomical pathway previously suggested by Ward and McCulloch on physiological evidence.
6. The extent and importance of frontal projections to the ventrolateral group of thalamic nuclei in the human brain is emphasized. A projection from the rostral cingular gyrus to the anterior nucleus of the thalamus could not be demonstrated.
7. Of the extrapyramidal nuclei, the finding of a direct corticopallidal pathway is of particular interest.
8. Fibres from the frontal cortex were seen to terminate in the red nucleus after lesions which certainly exclude areas 4 and 4 s.
- 9 Degeneration of fibres of the fronto-pontine tract in the most medial part of the peduncle was present after lesions anterior to the premotor cortex.

(Author's abstr.)

The Spontaneous Electrical Activity of the Human Thalamus.

1. Simultaneous records have been made of the electrical activity of the cortex, subcortical white matter, and the basal grey matter, notably the optic thalamus. These records were accompanied by E.E.G.'s, E.C.G.'s and other observations. They were made with an electrode needle presenting four point electrodes each 2 cm. apart from its neighbour down the length of the needle. The metal tube of the needle was earthed and insulated, thereby acting as an electrical screen to the independent and isolated electrodes. The electrode needle was introduced with the usual technique for a ventricular puncture, and the positions of the electrodes were determined by ventricular radiology. The methods are fully described.

2. Twenty-one subjects with diverse conditions, including organic brain damage and *grand mal* epilepsy, were studied. The encephalograms were modified in different ways during the periods of recording.

3. In most circumstances the thalamogram is featureless, whatever is occurring in the electroencephalogram.

4. Slow rhythms ($\frac{1}{2}$ –2 a second) occur when the thalamus is damaged by a tumour, and also occasionally when there is organic cortical damage.

5. Episodes of fast rhythms (16–22 a second) arise in the thalamus in a small proportion of subjects.

6. No relationship appears to exist between the spontaneous rhythms which may be seen in the thalamus in patients with organic brain damage, and the spontaneous rhythm of the cortex.

7. No reflection of induced changes in cortical rhythms can be seen in the thalamogram.

8. Although in some circumstances rhythms recorded from the cortex can be picked up from deeper structures, there is usually a striking independence of thalamic and cortical activity.

9. This preliminary survey suggests that with the methods so far available, exploration of the electrical activity of the basal grey matter has no immediate application to the routine investigation of organic brain disorder. The results can, however, be used as a baseline for the experimental study of abnormal states of behaviour, including epilepsy.

(Authors' abstr.)

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Basal Lead Studies in Epileptic Automatisms.

In a study of a selected group of 24 patients with epilepsy, the basal electroencephalogram was of particular interest in those cases with a history of automatisms. This report is concerned with the clinical and electroencephalographic findings in the 12 patients who were subject to this type of seizure. Among this group, spike activity was present in 10 instances and could be localized to the temporal or basal regions. In 7 instances the origin of the spike activity appeared to be nearer the electrodes at the base than at the scalp. The tendency for this activity to occur bilaterally has been emphasized. Of all the electrodes now applied to the outer cranium the nasopharyngeal and tympanic lie nearest the basilar parts of the rhinencephalon. Such anatomical considerations must be taken into

account in inferring the origin of the spike activity in the majority of the cases reported here. Some of the therapeutic and neurophysiological problems pertaining to the findings in these studies have been discussed.

(Authors' abstr.)

Metrazol Activation of Seizure Discharge in Epileptics with Normal Routine Electroencephalograms.

1. Slow intravenous infusion of 5 per cent. metrazol evoked seizure discharges in 47 per cent. of 57 epileptics who had normal routine E.E.G.

2. Rhythmic, repetitive discharges were characteristic of patients with "idiopathic" epilepsy, whereas arrhythmic, asymmetric discharges characterized the group classified as symptomatic epilepsy.

(Authors' abstr.)

Augmentation of Evoked Electro-cortical Activity During Spindle Bursts.

Several types of evoked electro-cortical activities have been observed to undergo pronounced augmentation during spindle bursts, and depression during the inter-burst period. The alternation is attributed to a periodic waxing and waning of background excitability, of which the burst may be a manifestation rather than a cause.

(Authors' abstr.)

Studies on Diffusion Respiration. VII. The Cortical Electrical Activity of Dogs.

1. The behaviour of the cortical electrical activity of dogs held in apnea by an overdose of Pentothal sodium for 45 min. under conditions permitting diffusion respiration has been studied.

2. The E.E.G. exhibited initial slowing followed by periodic suppression, and finally complete and continuous suppression. Continuous suppression appeared at an average of 19 min. of respiratory arrest and lasted until the apnea was artificially terminated, or for an average of 26 min.

3. The CO₂ content of the blood progressively increased throughout the apnea, and at the 45th min. of respiratory arrest the average venous blood pH had fallen from a control of 7.29 to the low value of 6.69.

4. The E.E.G. of all animals returned to normal within one week following the experiment.

(Authors' abstr.)

Effects of Di-Isopropyl Fluorophosphate (D.F.P.) on Electroencephalogram and Cholinesterase Activity.

1. The intra-carotid injection of D.F.P. produces electrical changes in the corticogram of the unanesthetized rabbit which, within limits, are proportional to the amounts of the anticholinesterase administered.

2. The decrease of cholinesterase activity in various parts of the brain is correlated with the degree of abnormality produced in the electrocorticogram. This relationship fails, however, when the *grand mal*-like electrical patterns develop, as the cholinesterase activity has previously fallen to a minimum.

3. It is suggested that in the production of the *grand mal*-like electrical pattern multiple factors may be involved.

(Authors' abstr.)

Cumulative Effects of Minimal Cortical Stimulations.

Five effects of local cortical faradic stimulation are described: (a) after-discharge; (b) spreading depression of the normal cortical activity; (c) a fast, low potential activity during the depression; (d) convulsoid activity, and activity resembling that recorded during experimental seizures, which may be present during the spreading depression and may replace it; (e) changes in the resting electroencephalogram. Changes in strength and duration of the stimulus affect mainly the afterdischarge. Repetition of a stimulus at 5- to 10-minute intervals enhances the afterdischarge and the fast, low potential activity. It is the only way in which the convulsoid activity has no peripheral motor equivalent.

(Authors' abstr.)

The Identity of Spreading Depression and "Suppression."

1. That type of electrical change characterized by the appearance of reduced electrical activity at the point of cortical stimulation, thence to appear in successive

fashion in contiguous areas of cortex, requiring minutes for such spread, has been identified in the literature with "suppression of electrical activity," a property ascribed only to certain "suppressor areas." Experimental evidence herein presented has shown that this phenomenon is actually due to the spreading depression of Leão, and cannot be distinguished from it by any presumed criteria of differentiation.

2. Spreading depression can be produced at times, under ill-defined conditions, by strychnine as well as by other methods of stimulation (chemical, electrical or mechanical) from any area of the cortex in cat and monkey.

3. The mechanism by which the changes of electrical activity, known under the general heading of spreading depression, are produced, is essentially cortico-cortical; further, it does not require neural continuity but only neural contiguity.

4. The type I or type II spreading depression of electrical activity is accompanied by a decrease in cortical excitability, as judged by decrease in cortically induced movements, and by a depression of strychnine spikes and sensory evoked potentials.

5. Stress has been laid upon the importance of considering mechanisms functioning independently of neuro-anatomical connections, as being of significance in function, either normal or abnormal. In particular, possible relationships between the phenomenon of spreading depression and the spread by contiguity of a focal epileptic discharge have been suggested. (Authors' abstr.)

Thalamocortical Activity During Spreading Depression.

Simultaneous recordings from cortex and thalamus were made during the spread of Leão's depression along the cortex of the rabbit. Twenty-six experiments were selected for report, all carried out upon animals under light anesthesia. Unique slow potentials, previously described by Leão (1944) as locally appearing concomitants of the process, were detected in the thalamus; and the sites of coincident appearance in cortex and thalamus correlate well with the anatomical projections between the thalamic nuclei and the cortex of the rodent. Outcroppings of fast paroxysmal discharge were similarly localized to corresponding cortical and thalamic points and support the linkages reported. Results obtained by the strychnine activation method also correlate.

Spread of depression or its associated slow potential discharges, originating at a point in the cortex and invading thalamic regions in succession, does not spread cortex to thalamus to cortex, but from successively activated cortical areas to their corresponding thalamic nuclei.

Other subcortical centers were not investigated.

(Authors' abstr.)

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*E.E.G. Studies of Changes Induced by Electric Shock in Man: II. *Wada, T.* 304

Electroencephalographic Studies of Changes Induced by Electric Shock in Man. II: Supplementary Observations.

The author reports electroencephalographic sequelae to electric shock rendered by bifrontal and ear hole application in 30 cases of psychosis, principally schizophrenic in character. He considers that the sequence of E.E.G. change in convulsion

following electric shock is similar to that obtained with convulsions of other etiology. In non-convulsive response to shock the E.E.G. recorded paralleled the level of consciousness attained. When ear hole application of shock is made, waves resembling those obtained in epileptic equivalent states occur, and the author suggests this as evidence that psychomotor activity in the E.E.G. is a manifestation of subcortical discharge. He believes he can relate the change in the electroencephalogram incident to shock therapy to the phenomena of facilitation and extinction observed in experimental studies of Adrian, Dusser de Barenne, *et al.*

(Courtesy of Biol. Abstr.) (Psychol. Abstr.)

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Electroshock Convulsions and Memory: The Interval Between Learning and Shock.

From the data it may be concluded that for these two subjects:

1. The effect of electroshock on learning and retention is slight or undetectable until a cumulative effect which appears suddenly and shows generally in the patient's behavior makes the subject unable to attain the criterion of learning.
2. The cumulative effect of electroshock convulsions on memory is reversible following cessation of shocks: the number of repetitions for learning and relearning gradually returns to the level preceding the electroshock convulsions.
3. The cumulative effect of electroshock convulsions on memory is apparently the same for material learned one hour before as for material learned just prior to electroshock.
4. The hypothesis that an electroshock convulsion, administered during a learning activity, would result in complete amnesia for that material is untenable.
5. Whether or not an electroconvulsive shock impairs learning ability and retention, then, depends on the number of shocks previously administered.

(Authors' abstr.)

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Multiple Sclerosis (Encephalomyelitis Disseminata Periaxialis) and the Vegetative Nervous System.

In both the gastrospasm and the enterospasm encountered in multiple sclerosis the most significant fact is the disharmony between kinetic and tonic impulses. That means a breach of the fundamental law of the gastro-intestinal innervation. The lack of pains in total gastrospasm and the involvement of the entire organ are important features. In view of the complex innervation of the viscera, due to the antagonism of the vegetative nerves and to the automatic function of these organs, it is most difficult to arrive at a precise concept of how the various components operate. In addition to the nerves, the author has further to consider hormonal influences arising from the endocrine organs and from the intestinal mucosa (enterogastrone?). The difficulties in the experimental study of the vegetative "centers" appear to be, to-day, insurmountable. A certain insight may derive from close clinical and anatomic studies. Virchow's cellular pathology, with its tendency of localizing, has won triumphs in the field of cerebral and spinal diseases. On the other hand, the better the close interrelationship of the inner organs and their domination by central factors is understood, the lesser the justification of a specialistic attitude. The outcome of Virchow's ideas is vanishing, and the necessity of considering the body as a unit is imperative. (Author's abstr.)

An Evaluation of Vitamin E Therapy in Diseases of the Nervous System.

Vitamin E, as present in wheat germ oil and natural mixed tocopherols, contains myotrophic and neurotrophic factors and is of importance in regulating capillary permeability. It influences favorably muscle growth in the young, and aids in increasing muscle strength and muscle tone. It has been found of value in selected cases of muscular hypotonia and muscular hypoplasia in the young. In cases of anterior poliomyelitis and infectious polyneuritis with residual muscular weakness it was found useful in hastening return of normal muscle function when combined with other methods of treatment.

It appeared to produce arrest or slowing down of progression of demyelination when used in combination with the B complex group of vitamins in certain demyelination states, including tabes dorsalis, amyotrophic lateral sclerosis and multiple sclerosis.

It should be given a trial in all cases of amyotrophic lateral sclerosis in the female, and is of some value in the spinal cases of amyotrophic lateral sclerosis in the male. It produced regeneration of atrophied musculature in one case of amyotrophy associated with tabes dorsalis and one case associated with multiple sclerosis when combined with intraspinal pyridoxine thiamine therapy and oral vitamin B complex.

In cases of congenital non-obstructive hydrocephalus it produced arrest or slowing down of progression of head enlargement. A number of children with progressive hydrocephalus have developed normally after receiving wheat germ oil for varying periods of time. It is suggested that congenital disturbance of the hematoencephalic barrier is probably responsible for many cases of hydrocephalus in the young, and that vitamin E is of value in restoring to normal the spinal fluid secretion-absorption mechanism in such cases.

In view of the non-specific beneficial effect of vitamin E on muscle tone and muscle tissue proliferation in the young it should be included, preferably in the form of wheat germ oil, as a necessary vitamin supplement in the diets of all infants and children manifesting defective maturation of their neuromuscular apparatus. (Author's abstr.)

The Use of Ephedrine Sulfate in the Control of Enuresis in Schizophrenic Regression.

Ephedrine sulfate, 0.048 gm., was administered daily during a testing period to 28 regressed schizophrenics to determine its effect on the enuresis manifested by each of these patients.

The results were presented and theories of the rationale of therapy were advanced. (Authors' abstr.)

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Positive and Negative Aspects of Hypothalamic Disorders.

The author must compare the effects of chronic hypothalamic affections in man with experimental results. His material illustrates the great variety in the clinical picture. These variabilities are caused (a) by differences in the localization and extent of the pathological process, (b) by their nature and the tempo of their development, and (c) by the age of the patient. Accompanying disturbances in the brain outside the hypothalamus may also play a role.

Clinico-anatomical observations seldom offer opportunities to connect functional disturbances with the damage of special hypothalamic nuclei. Hence the task of the clinician regarding the problem of functional localization is more difficult

than that of the physiologist. Clinical observations may, however, increase our insight into these relations, provided that they are carefully controlled by microscopical investigation. In comparing experimental results with those of clinicopathology one has to realize that the functional disorders that occur after experiments on animals are caused by acute lesions, in which the chains of neurones are suddenly interrupted. Observations in man, however, were on cases in which the pathological process developed slowly from the onset, so that compensation by other parts of the central nervous system might take place. To-day the best experimentally analysed syndrome is diabetes insipidus, but we have seen that, in man, bilateral destruction of the supra-optic nuclei does not always cause polyuria and polydipsia.

The author believes that the dorso-medial, ventro-medial and lateral nuclei of the tuber exert an important influence on vegetative functions, but up till now it is not proved that the different types of disordered metabolism correspond with lesions of distinct "centres." Hess (1948), whose method of electrical stimulation with very weak currents gives the most accurate results, also came to the conclusion that there is some localization of function in the hypothalamus, but that it is not limited to circumscribed "centres."

In order to explain the contradiction between the acute experimental and the chronic clinical facts in the central vegetative nervous system, one has to consider the relations in the somatic nervous system, where we meet the same difficulty. An acute lesion in man, for example, causes severe disturbances in motility or in sensibility which for the most part, after a time, gradually disappear. The theory of diaschisis of von Monakow (1905, 1914), which deepened the author's insight into cerebral localization of function, has to be applied also to the hypothalamus. Von Monakow pointed out that the various neurones are intimately connected: if one part suddenly drops out, this results in a functional reaction in all the parts of the brain linked up with the damaged area. But this reaction disappears after some weeks, and only the remaining symptoms have value for localization. Many facts shown by modern neurosurgery favour this conception. Foerster (1936), for example, showed that whereas excision of small parts of the anterior central gyrus in man causes total paralysis of the corresponding extremity, motility recovers very soon. Removal of circumscribed parts of the posterior central gyrus evokes loss of cutaneous and deep sensibility in the corresponding part of the body, but again recovery takes place, and after some time the usual methods of clinical examination fail to show any diminution of sensory function. Seen in this light, the results of the experimental method and of clinical pathology do not contradict each other. They only prove that there is a refinement in the functional localization in the brain, and not least in the vegetative central nervous system. Economic reasons incite Nature to follow frequently-used pathways. For the security of vital functions many fuses are placed in the central nervous system. If one of these breaks down, others redouble their activity.

At the present day scientific investigation is focused on the hypothalamus, but vegetative functions are also represented in other parts of the brain, for example in the cerebral cortex, although here they are spread more widely. The different negative cases in hypothalamic affections point clearly in the direction of this functional luxury. Positive and negative aspects have therefore to be studied with equal care.

(Author's abstr.)

The Effects of Diisopropylfluorophosphonate in Schizophrenia and Manic-Depressive Psychosis.

In 17 schizophrenic patients, 9 manic-depressive patients and 10 normal subjects, the effects of D.F.P. given intramuscularly in doses of 1 to 2 mgm. daily have been studied. Observations have been made of the effect of the drug on the cholinesterase activity of the blood, and on the physical and mental state of the patients. Electroencephalographic studies have also been carried out. The mean values for red cell and plasma cholinesterase activity obtained before D.F.P. treatment were not significantly different in the three groups of subjects. Administration of the drug produced marked inhibition of both types of cholinesterase activity, and the levels of inhibition were comparable in the two psychotic groups.

When D.F.P. was administered for a period of seven days, in a total dosage of 13 mgm., characteristic physical effects were produced, particularly on the gastro-

intestinal tract and on the cardiovascular system. These were considerably less marked in schizophrenic than in manic-depressive and normal subjects. There was a marked difference in the blood-pressure responses of the two psychotic groups. The possible significance of these findings is discussed.

A number of electroencephalographic changes are described, the most characteristic of which is lowering of amplitude associated with diminution of alpha activity. Approximately 24 hours after the withdrawal of D.F.P., however, an increase of amplitude with increased dominance and spread of the alpha rhythm was seen. No evidence of an epileptogenic action of the drug was observed. The incidence of E.E.G. changes was much greater in normal and manic-depressive subjects than in schizophrenic subjects. Atropine in doses of 1-5 mgm., subcutaneously, produced changes in the E.E.G. almost indistinguishable from those of the early stages of sleep, and did not counteract the effects of D.F.P. on the E.E.G.

The mental changes produced by the drug are illustrated by case-records. A characteristic depressive effect was observed in manic-depressive patients and in normal subjects. In a number of schizophrenic patients, on the other hand, an activation of the psychosis occurred which was not associated with disturbances of consciousness. (Authors' abstr.)

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Electronarcosis. II. Inhibition of Electrical Activity of Cerebral Cortex Following Application of Pulsed Stimulus to Diencephalon.

1. The application of a pulsed current directly to the diencephalon is followed by the appearance of continuous or spindled slow waves (10-18 per sec.) in the motor area of the cerebral cortex. The waves are bilateral in phase, but frequently of different amplitude. This state may progress to the complete inhibition of electrical activity. Occasionally spikes similar to those obtained from single wave or muscle fibers appear at a frequency of 10-18 per sec. These spikes are probably the expression of the activity of one or more cells which escape inhibition.

2. In a very limited area of the frontal lobes the effect of the stimulus is to accentuate the slow rhythms.

3. The area which, when stimulated, produces the inhibition of the cerebral cortex is close to the mammillary bodies next to the center controlling the electrical activity of the upper part of the spinal cord. (Authors' abstr.)

Electronarcosis. III. Inhibition of Cortical Electrical Activity Following Local Application of Pulsed Stimulus.

1. The application of a pulsed stimulus directly to the motor cortex alters the cortical electrical activity: the most important phenomenon is inhibition of such activity.

2. In the anterior part of the occipital lobe, after stimulation of the homolateral motor cortex, the same electrical signs are seen as in the contralateral motor cortex, the wave potentials being out of phase.

3. Stimulation of the anterior frontal area is without effect on its electrical activity: when the stimulation is applied on the motor cortex the normal alpha waves increase in amplitude. This increase of the slow rhythm may be due to a functional isolation of the frontal cortex to which impulses from the motor area are interrupted because of the inhibition. (Authors' abstr.)

After-potentials and Excitability of Spinal Motoneurones Following Antidromic Activation.

When motoneurones are activated by an antidromic volley, they generate after-potentials which have been recorded either with ventral root leads or with a micro-electrode in, or close to, the motor nucleus. Probably the early phase of after-negativity is in part due to a catelectrotonus of uninvaded motoneurones, and in part to a true after-potential of invaded motoneurones. The subsequent after-positivity (duration about 100 m.sec.) is a true positive after-potential of the invaded motoneurones.

Three types of testing stimulation (monosynaptic orthodromic, antidromic, and direct) have been used for investigating the changes in excitability of the motoneurones that are associated with these after-potentials. The deepest depression of excitability is invariably found at 10–20 m.sec. after the antidromic activation of motoneurones. As the testing interval is shortened there is always a phase of lessened depression—even of facilitation—while with lengthening intervals a gradual recovery to normal excitability is observed at 80–140 m.sec. Rarely a later prolonged depression is observed. Evidence is given that the phase of lessened depression at short intervals is in part attributable to the supernormality associated with the negative after-potential of invaded motoneurones, and in part to facilitation produced in uninvaded motoneurones by their catelectrotonic depolarization. In general the depression corresponds closely in its time course to the positive after-potential and is thus homologous with the subnormal state of peripheral nerve, though both the potential and the depression are much larger than with peripheral nerve.

At very short intervals the testing stimuli evoke responses only in those motoneurones not invaded antidromically. It is shown that such motoneurones can fire a reflex discharge down their motor axons as soon as 0.7 m.sec. after the arrival of the antidromic impulse at its site of blockage—presumably the axon hillock.

Even during the depth of the depression, a testing orthodromic volley sets up a synaptic potential showing little or no depression, but a large depression is observed at very short intervals after the antidromic volley (less than 6 m.sec.).

The relatively supernormal and the subnormal phases of excitability make it difficult to estimate the duration of the refractory period, but the absolutely refractory period is less than 1.3 m.sec., and the total duration of absolute plus relative refractoriness is 4–6 m.sec., which is in good agreement with values for blood-perfused mammalian nerve.

In the discussion it is shown on experimental grounds that the positive after-potential and the associated subnormal phase are located on the soma and proximal dendrites, i.e. in the area covered by synaptic knobs, and not, for example, in the dendritic terminals or interneurones. Explanations are offered for the recurrent discharge which is set up from a few motoneurones by an antidromic volley.

Previous attempts to test the effect of an antidromic impulse on the prolonged synaptic excitatory state (facilitation potential) are shown to be unsatisfactory. Every possible precaution is taken to make a new experimental investigation satisfactory, and the results do suggest that the prolonged facilitation state is extinguished when a motoneurone is invaded by an antidromic impulse. However, an alternative explanation is possible, and it is argued that a definitive result is only possible with the investigation of single motoneurones. (Authors' abstr.)

Dorsal Column Conduction of Group 1 Muscle Afferent Impulses and their Relay through Clarke's Column.

The largest afferent fibers, serving muscle, for the most part terminate in the upper lumbar and lower thoracic segments. During this relatively truncated course in the dorsal columns, after supplying myotatic reflex collaterals to the motoneurons, these fibers came into relation with the cells of Clarke's column, where a relay is established for the projection to the cerebellum of stretch-evoked activity.

Conduction velocity of impulses in the primary afferent fibers is strikingly non-linear. A volley engendered in the large afferent fibers of muscle has an initial velocity approximating 110 M. per sec. Once these fibers have entered the spinal cord velocity drops to about two-thirds the initial value. Further changes, occurring typically in the third and first lumbar segments, bring velocity to less than one-quarter the initial value. Less spectacular changes attend impulse conduction by the larger cutaneous afferent fibers. Impulses in the dorso-lateral tract conduct at a uniform velocity that compares with the initial velocity of impulses in the presynaptic afferent fibers from muscle.

The synaptic articulations which the large afferent fibers form with motoneurons and with the cells of Clarke's column differ characteristically, considerable summation being requisite for transmission in the motor nuclei, but not in Clarke's column.

Postsynaptic response in the dorso-lateral tract begins with a discharge relayed, with little time delay, at the caudal end of Clarke's column. Following this monosynaptic discharge is a series of discharges occurring with progressively increasing randomness. The mechanism of the later discharges is not known.

(Authors' abstr.)

Cortical Inhibition of Gastric Motility.

1. The effect of cortical electrical stimulation on gastric motility has been reviewed and studied in dogs.

2. Inhibition of pyloric antral motility occurs from the "insular-orbital" region and the sub-genual portion of the anterior cingulate gyrus.

3. No augmentation of antral motility was produced in this series by stimulation anywhere on the exposed cortex.

4. A functional relationship between the orbital surface and the anterior cingulate gyrus has been suggested, and the phylogenetic relationship of part of the "orbital surface" of the dog to the Island of Reil in man has been pointed out.

(Authors' abstr.)

Effect upon Blood Pressure of Electrical Stimulation of Tips of Temporal Lobes in Man.

1. Electrical stimulation of the tips of the temporal lobes has been found to produce an elevation of blood pressure in a patient under pentothal anesthesia.

2. Significant elevations occurred both in the systolic and diastolic blood pressures.

3. The blood-pressure responses were obtained using 10 cycles per sec., a pulse duration of 10 m.sec., and from 5 to 20 volts.

4. Suggestions are made of possible connections between the tips of the temporal lobes and the hypothalamus which might mediate the blood-pressure responses.

(Authors' abstr.)

Threshold of Action Potentials in Ear of Guinea-Pig.

A method is described for determining the threshold of auditory action potentials in the cochlea of the guinea-pig for frequencies below 1,000 cps. The method depends on cancelling the aural microphonic by a signal derived from the electrical current that produces the sound stimulus.

The action-potential threshold in decibels for tones below 1,000 cps. is a linear function of the logarithm of the frequency. The slope of this line varied from - 28 db. per octave in fresh preparations to - 1 db. per octave in animals treated with a large dose of quinine.

The "threshold" of the aural microphonic (intensity needed for a μ 1 v. response) when the intra-aural muscles are relaxed seems to be practically independent of

frequency from 1 to 5,000 cps., provided the microphonic at each frequency is measured close to its source. To make such measurements in the middle frequency range the action potentials must be suppressed. This can be done, with very little effect on the aural microphonic, by an appropriate dose of quinine. Less complete differential reduction of action potentials may occur "spontaneously," apparently as a result of the operative procedures involved in implanting electrodes in the cochlea.

In a fresh preparation the over-all "threshold of cochlear response" is determined by the aural microphonic at high and at low frequencies, but by action potentials over the middle frequencies. The apparent "threshold" curve is irregular because of re-enforcement or partial cancellation of the two components. The interaction varies with frequency and with the position of the electrodes.

The relationships to frequency of the action-potential threshold and of the microphonic differ widely (up to 28 db. per octave), and vary independently. The differential sensitivity of the ear with respect to frequency is determined in part by physical acoustic properties of the ear as a whole. For frequencies at least up to 1,500 cps., however, this sensitivity is even more importantly determined by a process closely related to the excitation of the nerve impulses, and subsequent to (or quite independent of) the aural microphonic. (Authors' abstr.)

Site of Action of Myanesin (Mephenesin, Tolserol) in the Central Nervous System.

1. The site of action of myanesin (mephenesin, tolserol) in the central nervous system has been studied in cats and monkeys.

2. In therapeutic doses of the drug (10-40 mgm./kgm. i.v.) the spinal mono- and multisynaptic reflex discharges were unaffected, as were the patellar, flexion, and crossed extension reflexes. With increased dosage the multisynaptic reflex discharges were depressed before the monosynaptic ones. Correspondingly, the flexion and crossed extension reflexes were found more susceptible to the drug than the patellar reflexes. In accordance with earlier observations it was found that hyperactive spinal reflexes (produced with light chloralose anesthesia or by injection of strychnine) were promptly reduced to normal with clinical doses of myanesin. The great enhancement of the multineuron discharge following the injection of strychnine could also be effectively counteracted with myanesin.

3. Facilitation and inhibition of the knee-jerk from stimulation of the brain stem reticular formation were reduced or abolished by myanesin in amounts of 20-30 mgm./kgm. The stimulus threshold for obtaining these effects was measured before and after the administration of the drug. In most experiments the two systems were about equally depressed, while in some preparations with very hyperactive reflexes facilitation was somewhat more reduced than inhibition.

4. Similar facilitation and inhibition obtained from the anterior lobe of the cerebellum were reduced with smaller doses of myanesin (10-20 mgm./kgm.). Cortically induced movements were reduced by doses of 15-35 mgm./kgm.

5. Spontaneous cortical and subcortical potentials were unaffected by clinical doses of myanesin. The repetitive discharges of the evoked cortical potentials were abolished with smaller doses of the drug than was the primary complex. Cortical after-discharges in chloralosed animals were reduced.

6. It is concluded that the more complex multisynaptic pathways are particularly vulnerable to myanesin. Such pathways are presumably involved in disorders which respond to myanesin, such as spasticity, rigidity, certain involuntary movements, *petit mal* epilepsy, and possibly certain types of pain.

(Author's abstr.)

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Electronarcosis. IV. Effects of Square Wave Application to Motor Area Following Destruction of Diencephalon.

1. After the diencephalic center has been destroyed by diathermy, stimulation of the cortex with interrupted current is without effect: after a few minutes the normal electrical activity of the cortex slowly decreases and the cortex is insensible to electrical, mechanical or chemical stimuli.
2. The phenomena described in the first paragraph of the Summary may be interpreted as due either to (a) fatigue of cellular elements of the cortex, whose activity is not controlled by the inhibitory diencephalic center, or (b) random activity such that the number of neurones in question being very great, the algebraic sum of their electrical manifestations tends to equal zero.
3. Electrical silence follows passage of the interrupted current, whatever may be the position of the recording electrodes on the skull.
4. After this stage electrical activity is resumed, characterized first by very rapid waves, which later increase in amplitude and appear in groups. During this period the patient has mental confusion and often catatony.

(Authors' abstr.)

Electronarcosis. V. Faradic Stimulation of Motor Area Following Diencephalic Diathermy.

1. If the motor cortex is stimulated with an inductorium instead of an interrupted current, wave potentials of the strychnine type appear, and a partial inhibition, similar to that obtained with the interrupted current, occurs.
2. In an animal in which the diencephalic centre has been destroyed, faradic stimulation of the motor cortex is without effect; on the contrary, strychnine solutions applied to the cortex give rise to the appearance of strychnine waves. The application of interrupted current in the presence of strychnine does not produce inhibition, as when the diencephalic centre is intact, but only a local excitation.
3. In conclusion, a demonstration has been presumably given of a centre extending from the frontal part of the diencephalon back to the pons. This centre has a regulatory function on all parts of the central nervous system, from the telencephalon to the spinal cord, and it has a segmentary structure and the segments may be independently stimulated both directly or reflexly.

(Authors' abstr.)

Some Connections of the Orbito-fronto-temporal, Limbic and Hippocampal Areas of Macaca mulatta.

1. By means of the technique of physiological neuronography some of the connections of the rhinencephalic and limbic areas of *Macaca mulatta* have been investigated in an attempt to extend reports of previous studies.
2. The following areas can be recognized by differences in their firing patterns: trigonal, subcallosal and medial orbital, precallosal cingulate, supracallosal anterior cingulate, supracallosal posterior cingulate, retrosplinal, posterior orbital and anterior insular, temporal polar, periamygdaloid, and entorhinal. An attempt has been made to correlate these with cytoarchitectural differences and with subcortico-cortical connections whenever possible. Some of the connections of the hippocampus and amygdala were also investigated.
3. The cortico-cortical interconnections of these areas suggest that they fall into three groupings: (i) The trigonal, subcallosal and medial orbital, precallosal cingulate, posterior orbital and anterior insular, temporal polar, periamygdaloid and entorhinal areas are heavily interconnected. This group may be referred to as the orbito-fronto-temporal region. (ii) The second group includes the projection areas of the three divisions of the anterior thalamic nucleus. There are three of these areas: supracallosal anterior cingulate, posterior cingulate, and retrosplinal. According to previous studies, these areas are closely related to the

cortex surrounding the cingulate sulcus and to certain aspects of the lateral surface of the hemispheres. They are functionally interconnected by extremely short fiber systems. This group may be referred to as the limbic region. (iii) Finally, the consideration of the hippocampal formation as a separate region is tentative until its relation to the orbito-fronto-temporal and the limbic areas is further clarified and any possible connections with the lateral neocortex investigated.

(Authors' abstr.)

Recovery of Skilled Motor Functions after Small Repeated Lesions of Motor Cortex in Macaque.

1. Small lesions in the thumb or hand area of the motor cortex revealed that no definite area within the internal capsule can be assigned to the cortico-spinal fibres coming from a particular subdivision of area 4. Moreover, small lesions in the hand area caused degeneration down to the lumbar region, suggesting that subdivisions of area 4 connect with several spinal levels.

2. It was found that small lesions to area 4 produced a contralateral paralysis and inability to perform a delicate skilled motor act, such as opening a puzzle box. This paralysis was followed by a considerable degree of recovery and a return of motor skill.

3. When, after recovery, area 4 was again exposed, parts adjacent to a lesion in the hand area gave hand responses which were not detectable at the earlier operation. Undercutting of these subdivisions caused a recurrence of paralysis and loss of motor skill in the previously recovered arm.

4. It is suggested that the motor cortex does not function as a mosaic but has a tendency when a lesion occurs to act in a less differentiated and more primitive manner, which may be made possible by the plurisegmental connections of area 4 described in our experiments.

(Authors' abstr.)

Course of Spinothalamic and Medial Lemniscus Pathways in Cat and Rhesus Monkey.

1. Stimulation of the sciatic and saphenous nerves of cat and rhesus monkey initiated potentials in the medulla oblongata, midbrain, thalamus and internal capsule which were characterized by an initial, rapidly conducted spike which was followed occasionally by slower spikes.

2. A large portion of the afferent pathways from the saphenous nerve passed lateral to the inferior olive.

3. The afferent impulses from both the sciatic and saphenous nerves traversed the midbrain in a restricted area corresponding to the medial lemniscus, and then entered the nucleus ventralis posterolateralis.

4. Impulses following sciatic and saphenous nerve stimulation ascended in the same relative positions on both sides of the brain stem.

5. The components of the medial lemniscus from the gracilis and cuneatus nuclei completely crossed to the opposite medial lemniscus and thalamus.

(Authors' abstr.)

After-potentials and Excitability of Spinal Motoneurones Following Orthodromic Activation.

Motoneurones innervating a particular muscle (usually gastrocnemius) have been subject to orthodromic activation by a single synchronous volley that was set up by stimulation of group I afferent fibres of that muscle. When the volley was so small and/or the anaesthesia so deep that no reflex discharge was evoked, the negative synaptic potential recorded from an emerging ventral root was followed by an after-positivity persisting for about 100 m.sec. When a reflex discharge was superimposed on the synaptic potential, there was a corresponding increase in the after-positivity.

A testing monosynaptic orthodromic volley has been used for investigating the changes in excitability of the motoneurones that were associated with these after-positivities. When the conditioning and testing volleys were set up in the same muscle afferent fibres (group I only), the deepest depression of excitability occurred at 10-30 m.sec. (complete suppression of the testing reflex response), and initially, recovery occurred along much the same time course as after antidromic activation of motoneurones. However, unlike the latter, this phase of

recovery was always incomplete and followed by prolonged slow recovery of excitability, which was still incomplete at the longest test interval of 660 m.sec.

A similar, but less intense, depression with two-stage recovery was observed after a conditioning volley which was so small that it evoked little or no reflex discharge. However, when this reflexly subliminal volley was in a different (synergic) nerve from the testing volley, little or no reflex depression was usually observed.

It is concluded that the initial phase of depression is attributable to a subnormal state of motoneurons during the positive after-potential that follows their response to the conditioning orthodromic volley, and is recorded after electrotonic spread to the ventral root. It is evident that the reflex discharge of an impulse should set up an after-potential and depression similar to that following antidromic invasion of that motoneurone.

It is shown that the after-positivity and associated depression following reflexly subliminal activation is, according to the electrical hypothesis, likewise attributable to the positive after-potential following the local responses of the subsynaptic areas of a motoneurone. On the available evidence the prolonged phase of depression is located in the presynaptic pathway. (Authors' abstr.)

Excitation of Single Nerve Fiber by Action Current from Another Single Fiber.

By the method of bridge-insulator, action currents from an isolated nerve fiber were led to another fiber without appreciable leakage. In many cases it was observed that an impulse initiated in the primary fiber jumped to the secondary fiber at the insulated region. Application of a hypertonic NaCl solution upon the region of electrical contact of the two fibers facilitated the jump of impulse. It was shown that a concentrated NaCl solution reduces the membrane resistance of the nerve fiber and prolongs the action current. (Author's abstr.)

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Experience with Topectomy for the Relief of Intractable Pain.

1. Following Pool's lead in the surgery of mental disorders, bilateral topectomy of the 9, 10, 46 region was performed, since 1947, on 25 patients suffering from different kinds of unbearable pain.

2. Results are generally good with a bilateral cortical excision of a total of about 20 to 25 gm. Unilateral topectomy failed often. Some results have lasted nearly 2 years to date.

3. Different classes of unbearable pain are analysed. The action of topectomy is beneficial on both organic unbearable pain or the so-called "psychic" pains. Indications for other operative procedures are discussed.

4. An objective technique of measuring unpleasant and unbearable pain is given. Such a condition is called *souffrance*, and its close relationship with anxiety is shown. A step is taken in bringing a mental condition up (or down) to a physiological phenomenon.

5. Possible mechanisms and localizations involved are briefly discussed.

(Author's abstr.)

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Clovis Vincent, His Life, and Main Contributions to Neurosurgery. *le Beau, J., and Tavernier, J. B.*

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Experiences with Unilateral Prefrontal Lobotomies for Pain.

1. In a series of 16 cases of intractable pain treated by unilateral lobotomy, lasting relief was obtained in 50 per cent. of the series.

2. In some instances, at least, unilateral lobotomy gives effective relief when the pain is diffuse, when it is due to direct nerve involvement, or when it occurs in the upper extremities or head.

3. The authors' experience has suggested that complete unilateral leucotomy is more effective than a medial incision that does not include the superior lateral quadrant.

4. The most impressive advantages of the unilateral operation are the minimal surgical risk and the absence of marked post-operative mental change.

5. Pain was subsequently controlled satisfactorily by making the operation bilateral in 3 cases. Other pain-relieving operations were successfully used in several additional cases.

6. On the basis of this small series of cases, the authors feel that unilateral lobotomy has a definite place in the treatment of intractable pain, and deserves further trial. Subsequent operation on the second side may always be added if necessary.

(Authors' abstr.)

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General Survey of Insulin-treated Patients after Five Years.

A long-term follow-up of schizophrenics who were treated with insulin shock therapy reveals the following:

(1) There is no apparent difference between males and females in correlations between diagnosis, condition after treatment or, at present, duration of illness prior to treatment, or the length of time and adjustment outside of the hospital after release.

(2) Chronic cases are more benefited by intensive coma treatment than by light treatment combined with personal care.

(3) Those who showed the most improvement at the completion of treatment have also shown the greater ability to remain in the community.

(4) Acute cases appear to have a better prognosis than chronic cases. The five-year prognosis is poor for both acute and chronic, the acute cases still doing better than the chronic.

(5) Some chronic patients who were ill over three years have made as good outside adjustments as have some of the patients with short histories of illness before treatment was initiated.

(6) A certain percentage of chronic cases does respond favorably to insulin-coma therapy.

(Authors' abstr.)

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 *Spreading Depression of Electrical Activity in the Cerebral Cortex Following Local Trauma and its Possible Role in Concussion. *Echlin, F.* 199

Electrical Potentials of the Corpus Striatum and Cortex in Parkinsonism and Hemiballismus.

The experimental group consisted of 11 patients, 10 with paralysis agitans and 1 with hemiballismus, the control group consisting of 11 patients without identifiable "organic" diseases of the brain. The authors passed into the corpus striatum and environs a special needle, equipped with 8 ring-type "pick-up" electrodes, through a burr hole in the anterior vertical region of the skull in unanesthetized patient. E.E.G. tracings were analysed in respect to frequency, voltage and relative polarity of waves. Wave frequency of the corpus striatum and contiguous area is greater than that of cerebral cortex; no consistent relationship was demonstrable between the polarity of the striatal and neighboring electrical potentials and those of the cerebral cortex; certain portions of the striatal region tend strongly to exhibit a sustained, corresponding polarity of their respective action potentials; "voluntary" movements of the upper and lower limbs and stimulation of the cutaneous surfaces of these members with the point of a pin do not produce perceptible wave changes; certain tracings obtained from patients afflicted with paralysis agitans are characterized by frequencies of striatal waves appreciably greater than those seen in control subjects.

F. C. SUMNER (Psychol. Abstr.).

Spreading Depression of Electrical Activity in the Cerebral Cortex Following Local Trauma and its Possible Role in Concussion.

Weak faradic stimulation or tapping locally of the cortex with a glass rod causes a marked decrease in the spontaneous electrical activity of the cortex at the stimulated point which spreads outward, and within 3 to 6 minutes involves the entire cortex of the hemisphere stimulated. Leão has called this phenomenon "spreading depression." Recovery takes place within 5 to 10 minutes. The present author reports his study of spreading depression in rabbits under nembutal anesthesia, and points to the striking similarity between the E.E.G. findings in rabbits showing "spreading depression" in cerebral cortex, and those shown to occur following experimental concussion. It is concluded that the

E.E.G. findings in concussion may be largely explained on the basis of a "spreading depression" of electrical activity initiated from innumerable points in cerebral cortex simultaneously.

F. C. SUMNER (Psychol. Abstr.).

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1. Biochemistry, Physiology, Psychiatry, &c.

Variation in Acetylcholine Content of the Brain with Physiological State. Richter, Derek, and Crossland, James. [*Am. J. Physiol.*, **159**, 247-55 (1949).]

The acetylcholine content of the rat brain depends on the physiological state. It is increased in Na pentobarbital anaesthesia and in sleep; it is reduced in emotional excitement, in electric stimulation, and in convulsions. It thus appears to vary inversely with the degree of activity of the brain.

E. D. WALTER (Chem. Abstr.).

Specificity of the Trimethylammonium Group in Acetylcholine. Holton, Pamela, and Ing, H. R. [*Brit. J. Pharmacol.*, **4**, 190-6 (1949).]

The effect of replacement of the N-methyl groups of acetylcholine by Et groups and by acetoxyethyl groups was studied, by using the cat's blood pressure, guinea-pig ileum frog heart, and frog rectus muscle. The replacement of one Me group of acetylcholine by Et reduces the activity of the compound. The replacement of 2 Me groups produces a much greater reduction proportionally. The replacement of 3 Me groups altered the pharmacological effect, and produced paralysing nicotine-like effects on the cat's blood pressure and superior cervical ganglion. It also antagonized acetylcholine in the frog heart and the rabbit auricles. The replacement of 1 or 2 Me groups by acetoxyethyl reduced activity more than replacement by Et. This suggests that 2 N-Me groups play an important part in the structural specificity of the acetylcholine molecule, and a form of attachment by means of 2 Me groups, as well as by the acetoxy group, is suggested. The 1, 2, and 3-N-ethyl substituted compounds were hydrolyzed at the same rate as acetylcholine by the cholinesterases of dog's caudate nucleus and cobra venom, but less rapidly when horse serum was used. The 3 enzyme preparations hydrolyzed both ester groups of bisacetoxyethyl dimethylammonium iodide, and, more slowly, tri(acetoxyethyl)methylammonium iodide.

LA VERNE L. KIESSLING (Chem. Abstr.).

Influence of Acetylcholine on the Resting Potential of Striated Frog Muscle. Bartels, Heinz. [*Arch. ges. Physiol. (Pflügers)*, **250**, 277-94 (1948).]

Muscle-sections responded to 10^{-3} acetylcholine (I)/100 c.c. Ringer solution (II) only if they contained nerve endings, in which case the resting potential became more negative. The potential changes developed exponentially, reaching half the maximum value in about one minute, then reaching the maximum value (an average of 4-5 mv. under the most favourable conditions) in 5 or 10 minutes, and taking at least 30 minutes to return half-way to the control value. The duration of the tonic contraction induced by (I) was dependent on the dose of (I), and was shorter than the time taken to reach the maximum negative potential. Previous and concurrent treatment with prostigmine (III) increased the sensitivity of the sartorius muscles of frogs collected from January to March to the point where 10^{-5} gm. (I)/100 c.c. (II) was effective. The optimum concentration of (III) for this effect was 10^{-2} gm. (I)/100 c.c. With frogs collected from April until July, 10^{-3} gm. (I)/100 c.c. was necessary to produce an effect with or without (III), but in general the lowering of potential was somewhat greater for these frogs.

MARSHALL E. DEUTSCH (Chem. Abstr.).

Effect of Vitamin B₁ on Acetylcholine. Laos, Pablo A. [*Rev. facultad farm. y bioquim., Univ. nac. mayor San Marcos (Lima, Peru)*, **10**, 50-9 (1949).]

Twenty mgm. of acetylcholine (I) in contact with dog blood loses its hypotensor effect within 3 minutes due to hydrolysis by cholinesterase. When (I) is added to

mixtures of blood and vitamin B₁ which stood for 10 and 30 minutes respectively, (I) becomes ineffective only after 12 and 60 minutes respectively. Apparently cholinesterase is inhibited by vitamin B₁.

J. H. WEISBURGER (Chem. Abstr.).

The Quantitative Relationship of Antagonism Between Acetylcholine and a Synthetic Curare (2559 F). Guarino, Salvatore, and Bovet, Daniele. [Rend. ist. super. sanità, **12**, 215-36 (1949); cf. C. A. 1603d.]

On the basis of the wide dosage applicable, 2559 F (triiodethylate of 1, 2, 3-tri-(2-diethylaminoethoxy)benzene) was shown to be suitable for the estimation of the acetylcholine/curare antagonism on the rectus abdominis muscle of the frog.

VINCENT C. PETRILLO (Chem. Abstr.).

Relations Between Acetylcholine Synthesis and Metabolism of Carbohydrates and D-Glucosamine in the Central Nervous System. Harpur, R. P., and Quastel, J. H. (Montreal Gen. Hosp. Research Inst., Montreal, Can.). [Nature, **164**, 779-82 (1949).]

Extracts of acetone-dried brain powder can produce adenosinetriphosphate (I) from the glycolysis of glucose and fructose for the synthesis of acetylcholine (II). Glucose and fructose inhibit (II) synthesis in brain extracts. (II) synthesis is inhibited by similar concentrations of D-glucosamine, which may also be phosphorylated by brain extracts at the expense of (I). The fall of (I) concentration, because of the hexose phosphorylation, may be responsible for the inhibitory action on (II) synthesis. N-Acetylglucosamine competes with D-glucosamine and fructose for the phosphorylase involved in the reaction with (I), but N-acetylglucosamine is not phosphorylated. N-Acetylglucosamine prevents the dephosphorylation of (I) by D-glucosamine and fructose, and N-acetylglucosamine stops the inhibition of (II) synthesis. The affinity of glucose for the phosphorylase far exceeds that of fructose and D-glucosamine, and little or no relieving action of N-acetylglucosamine is found on the glucose inhibition. Diphosphopyridine nucleotide, which by enabling glycolysis to take place causes (I) to be produced at a rate comparable with the rate of its breakdown, is destroyed by a diphosphopyridine nucleotidase present in brain extracts. An extract of acetone-dried brain powder, when added to a medium containing glucose and (I), normally shows little or no glycolysis or (II) formation. If the action of the diphosphopyridine nucleotidase is inhibited by nicotinamide in the above system, a high rate of glycolysis and (II) synthesis results. In an anaerobic system (cysteine-nicotinamide-extracts of acetone-dried brain powder containing (I)) glucose can be replaced by fructose for (II) synthesis. In this complete system (II) synthesis closely follows glycolysis.

CHESTER HARGREAVES (Chem. Abstr.).

The Parallelism Between the Curarizing Action of Certain Synthetic Curares and the Antagonistic Effects of Acetylcholine. Marotta, Maria. [Rend. ist. super. sanità, **12**, 242-8 (1949).]

A general comparison is made of pure alkaloids and synthetic curares, considering the parallelism between their curarizing action and the antagonism they exercise against the contraction caused by acetylcholine on the muscle of the frog.

VINCENT C. PETRILLO (Chem. Abstr.).

The Cerebrospinal Fluid in Some Cases of Heine Medin's Disease. Ferrando, Elias, Ringuet, Maria L., and Dato, Alfredo Actis. [Rev. asoc. bioquim. argentina, **16**, No. 65, 20-31 (1949).]

In 92 cases of Heine Medin's disease the cerebrospinal fluid was nearly normal, with a tendency to increased content of albumin, glucose, and white corpuscles, and to decreased chloride. The globulin reaction was negative in 64 and weakly positive in 18 per cent. of cases.

F. F. (Chem. Abstr.).

The Cerebrospinal Fluid in Rheumatoid Spondylitis. Boland, Edward W., Headley, Nathan E., and Hench, Philip S. (Mayo Clinic, Rochester, Minn.). [Ann. Rheumatic Diseases, **7**, 195-8 (1948).]

In 50 cases of rheumatoid spondylitis the concentration of spinal fluid sugar was normal in 70 per cent., slightly low in 12 per cent., and slightly high in 18 per

cent. of the cases. An abnormal colloidal Au reaction was present in 1 per cent. of the cases. The protein concentration in the cerebrospinal fluid was increased in 42 per cent. of the cases, but there was no consistent relationship between blood and cerebrospinal fluid protein concentrations.

E. K. WEISBURGER (Chem. Abstr.).

The Pressure of the Cerebrospinal Fluid during Acetylcholine Shock. Alema, G., Mengoli, G., and Nobile, S. (Univ. Bologna, Italy). [Boll. soc. ital. biol. sper., **24**, 904-7 (1948).]

The pressure of the cerebrospinal fluid of 30 persons reached a maximum 30 seconds after injection of 0.01 gm. kgm. acetylcholine (I). The maximum was mostly followed by a plateau of 1-2.5 minutes' duration. The return to normal pressure occurred in 2-15 minutes. The relation of these changes to those of the blood pressure (II) is discussed.

Arterial Pressure, Capillaries, and Photoplethysmogram in the Acetylcholine Shock. Alema, G., and Nobile, S. [Ibid., 907-9.]

An initial decrease of (II) and pulse for a few seconds was followed in 18 of 30 persons with 1 shock by a high (II) crisis and an increase in differential pressure (III) and of the oscillometric index (IV). In 9 cases (II) was lowered, while (IV) remained unchanged, and (III) varied in all possible ways. The rest of the persons showed no change of (II), (III) or (IV). A contraction of the capillaries was seen in 13 persons. An increase of the curve of the photoplethysmogram was seen in 6 of 8 cases. It began 2-3 minutes after injection of (I) and lasted for 4-8 minutes. In 2 cases, in which (II) and (IV) did not vary, the curve decreased.

F. FROMM (Chem. Abstr.).

Multiple Sclerosis and Cerebrospinal Fluid Analyses. Kraus, Wolfgang (Bad Cannstatt, Ger.). [Deut. med. Wochschr., **74**, 1229-30 (1949).]

Cerebrospinal fluids (300 samples) of 273 patients in various stages of the disease were studied. Of these, 60 normal samples were drawn from severe and typical cases in the initial as well as advanced stages. The data as related to severity and duration of the diseases are given in 3 tables, but no specific conclusions are drawn.

D. L. NOETHER (Chem. Abstr.).

The Sugar and Calcium of Cerebrospinal Fluid in Koreans. UiSun, Lim. [J. Korean Med. Assoc., **2**, No. 1, 46 (1949).]

The sugar content of cerebrospinal fluid was 31-111 mgm. per cent. in men, average 65.9, and 34-114 mgm. per cent. in women, average 66.8. The Ca content of spinal fluid was 3.2-12 mgm./100 c.c. in men, average 5.95, and 3.8-11.2 mgm./100 c.c. in women, average 6.22.

I. S. YUN (Chem. Abstr.).

Effect of Cholinesterase Inhibitors on the Toxicity of Procaine in Mice. Conway, A. C., Ting, K. S., and Coon, J. M. [J. Pharmacol Exptl. Therap., **96**, 472-6 (1949).]

In mice, physostigmine and diisopropyl fluorophosphate had a significant protective effect, raising the LD₅₀ of procaine 23 and 16 per cent. respectively. Neostigmine and "carbamate acid N, N-dimethyl-4-dimethylamino-3-isopropyl-phenyl ester methiodide" increased the susceptibility of mice to the toxic action of intravenous procaine, lowering the LD₅₀ by 35 and 22 per cent. respectively. Methacholine had no significant effect on the toxicity of procaine. These results indicate that the reputed antiprocaine esterase activity of the cholinesterase inhibitors probably does not influence the toxicity of procaine in mice, and that other factors must be considered to explain the influence of these agents on procaine toxicity.

L. E. GILSON (Chem. Abstr.).

Mechanism of the Inhibition of Rat Brain Cholinesterase by Diisopropyl Fluorophosphate, Tetraethyl Pyrophosphate, and Eserine. Bain, James A. [Proc. Soc. Exptl. Biol. Med., **72**, 9-13 (1949).]

The mechanism of inhibition of rat brain cholinesterase by the 3 most potent anticholinesterases, diisopropyl fluorophosphate, tetraethyl pyrophosphate, and

amino acids, and total lipides. There is evidence for the occurrence in the nervous system of lipides (not sphingomyelin) whose P is difficult to release with KOH, and of phosphatides containing more than 1 molecule glycerol per 1 atom P. Hydrolysis with saturated aqueous Ba(OH)₂ liberates all lipid choline. The effect of autolysis or of formalin preservation on the lipides of nervous tissue is discussed. The axon and nerve-cell cytoplasm contain chiefly lecithin and phosphatidyl ethanolamine (1:1 percent. of fresh tissue); also a few tenths of 1 per cent. gangliosides and possibly minute amounts of cholesterol. However, cholesterol and cerebrosides predominate in the myelin sheath, which also contains phosphatidyl serine, sphingophospholipides and a trace of lecithin, but generally no neutral fat or cholesteryl esters. The molecule ratios between the first 6 lipid groups are 8:4:2:2:2:1. These studies revealed further that no significant differences exist in the lipides of different regions of the brain cortex, and in general the lipides are the same in comparison, but higher in concentration than in the grey nerves. The nerves of the lobster differ from the unmyelinated vertebrate nerves, in that the phospholipid is made up largely (80 per cent.) of a lecithin-like substance and practically no cerebrosides. The white matter of the cord is definitely richer in lipides than that of the brain. Interesting diagrams are given to illustrate the changes in over-all lipid content as well as in the comparison of the lipid material of the brain and cord of the rat at different stages of development from 7 to 70 days after birth. Neither acute lack of choline or thiamine nor relative lack of vitamin A or pantothenic acid during early development alter the lipid formation in the rat. The lipid complex of glioma and meningioma is similar in comparison, but much less than in ordinary grey matter. The most striking change in lipides during Wallerian degeneration is the big decrease in sphingomyelins and simultaneous increase in phospholipid resistant to KOH (choline-free). Lecithins are lost later in the degenerative process. Esterification of cholesterol sets in only after leucocytic infiltration, when a rapid removal of lipides also occurs. Diffuse sclerosis and encephalitis are accompanied by loss of lipides chiefly characteristic of the myelin sheath. The appendix describes all the analytical procedures, and includes 201 references.

S. MORGULIS (Chem. Abstr.).

Synthesis of and Decomposition of Polysaccharides in the Brain. Palladin, A. V. [Fiziol. Zhur. S.S.S.R., **35**, 596-603 (1949).]

Phosphorylase is able to act on the polysaccharides formed in the brain tissue by the action of brain amylase. The system polysaccharides-glucose 1-phosphate-dextrin may be represented by an equilibrium triangle on the basis of *in vitro* enzymic studies using brain macerates of rabbits, cats, and cows.

G. M. K. (Chem. Abstr.).

The Development of Muscle-Chemistry: A Lesson in Neurophysiology. Muralt, Alexander v. (Hallerianum, Bern, Switz.). [Biochim. et Biophys. Acta, **4**, 126-9 (1950) (in English).]

A review with 30 references.

G. G. (Chem. Abstr.).

Lipides of Normal Brain. Johnson, A. C., McNabb, A. R., and Rossiter, R. J. [Biochem. J., **43**, 573-7 (1948).]

By use of micro-methods, the concentrations of free and total cholesterol, cerebroside, total phospholipid, monoaminophosphatide and lecithin were determined (and from these the concentrations of ester cholesterol, sphingomyelin and cephalin were calculated), in whole brain of guinea-pigs, cats, and rabbits, and in white and grey matter from the brain of cat, dog, beaver and man. The concentrations (in mgm./100 gm. of fresh tissue) were in all cases greater in white than in grey matter. As a percentage of "essential lipides," the concentrations of cerebroside, total cholesterol, and sphingomyelin were greater in white matter, and lecithin and cephalin in grey matter. The results are compared with those of other workers on the same and other species.

B. A. (Chem. Abstr.).

Phosphorylation of D-Glucosamine by Brain Extracts. Harpur, R. P., and Quastel, J. H. [Nature, **164**, 693-4 (1949).]

D-Glucosamine (I) is phosphorylated at the expense of adenosinetriphosphate (II) in the presence of extracts of acetone-dried brain; (I) also produced an inhibi-

tion of the rate of acetylcholine (III) synthesis in these extracts. Beef brains were obtained within 30 minutes of the death of the animals, the grey matter removed and ground in ice cold acetone. After filtering, the resulting powder was stored in a vacuum desiccator in the cold. Extracts of the resulting powder were made with water, centrifuged, and the opalescent centrifugate was used for phosphorylation studies with the Warburg manometer. Rates of gas output by glucose (IV), fructose (V), and (I) in the presence of 0.002 M (II) were determined. With low concentrations of (IV), where the (II) concentration is in no way limiting, the gas output in the first 15 minutes approaches the theoretical value for the conversion of (IV) to hexose diphosphate. The maximum velocity of phosphorylation takes place with a lower concentration of (IV) than that of (V), while the speed of phosphorylation of (I) is appreciably less than that of (V). Kinetic studies indicate that the affinity of (I) to the enzyme involved is of the same order as that of fructose. Experiments with mixtures of the hexoses and (I) at appropriate concentrations indicate that no addition of the rates of phosphorylation occurs, and the results are consistent with a competition of all 4 substrates for the enzyme involved. The inhibition by (I) of hexose phosphorylation by (II) might be explained by a competition, not for a common enzyme, but for the (II) itself. This explanation is made unlikely by the finding that N-acetyl (I), which is not phosphorylated, exercises a large inhibitory action on the rates of phosphorylation of (I) and of (V).

BERNARD WOLNAK (Chem. Abstr.).

Oligophrenia Phenylpyruvica. I. Microbiological Determination of L- and D-Phenylalanine and of Phenyllactic Acid. Prescott, Blanche A., Borek, Ernest, Brecher, Arthur, and Waelsh, Heinrich (N.Y. State Psychiat. Inst., New York, N.Y.). [*J. Biol. Chem.*, **181**, 273-9 (1949).]

In a synthetic medium, free of phenylalanine (I), no visible growth is obtained with *L. arabinosus* during the first 40-44 hours. Addition of L-(I) or L-, D, or DL-phenyllactic acid (II) up to 8 γ /ml. gave an equal growth response. Phenylpyruvic was also able to replace L-(I), while D-(I) gave no growth and DL-(I) gave only half of the normal growth. Combined L-(I) and D- and L-(II) were determined microbiologically after phenylpyruvic acid was removed by heating with 0.3 parts 6 N HCl in a closed tube at 105° for 15 hours. The L-(I) and the (II) were separated by extraction with Et₂O or CHCl₃ and then determined. Any D-(I) present together with L-(I) in the watery layer was easily determined by deamination with NaNO₂ and conversion to (II). Plasma of patients with oligophrenia phenylpyruvica contained no D-(I), but 34.5 mgm. per cent. of L-(I) compared to 0.95 mgm. per cent. found in normal persons.

B. L. (Chem. Abstr.).

The Effects of Drugs on the Electrical Activity of the Brain. Toman, James E. P., and Davis, Jean P. (Univ. of Utah, Salt Lake City). [*J. Pharmacol. Exptl. Therap.*, **97**, No. 4, Pt. 11, *Pharmacol. Revs.*, 425-92 (1949).]

L. E. GILSON (Chem. Abstr.).

Inhibitory Effect of Muscle Adenylic Acid on Anaerobic Glycolysis of Brain. Greenberg, G. Robert (Western Reserve Univ., Cleveland, O.). [*J. Biol. Chem.*, **181**, 781-8 (1949).]

Anaerobic glycolysis by homogenates of mouse brain or of Me₂CO-powder of swine brain was inhibited by adenosine-5-phosphoric acid (I) and, still more, by inosine-5-phosphoric acid. Adenosine (II), (II)-3-phosphoric acid or (II) triphosphate failed to produce this inhibition. When the initial inhibition due to (I) was low, the inhibition tended to disappear with time, but a marked initial inhibition usually increased with time. The inhibition due to (I) was rapidly overcome by addition of 4.1×10^{-3} M hexose diphosphate. Possible reasons for these effects are discussed.

MARSHALL E. DEUTSCH (Chem. Abstr.).

Chemical Studies of Peripheral Nerve During Wallerian Degeneration. Johnson, A. C., McNabb, A. R., and Rossiter, R. J. (Univ., Western Ontario, London, Can.). [*Biochem. J.*, **45**, 500-8 (1949); cf. *C. A.*, **44**, 213d.]

The concentration of cholesterol esters, sphingomyelin, cephalin, essential lipide, myelin lipide, and total lipide was determined in degenerating cat sciatic nerves

4-96 days after sectioning. The wet weight of the sectioned nerve increased temporarily (maximum in 4 days), but returned to normal after 64 days. The total lipide decreased steadily. The neutral fat decreased rapidly to a minimum (4-8 days), and returned to normal in 32 days. Myelin lipides (cerebroside, sphingomyelin, free cholesterol), unchanged at first, decrease rapidly between 8-32 days. The same is true for free cholesterol, but cholesterol esters, absent in control nerves, increased, reaching a maximum by the sixteenth day. Essentially the same changes were observed with regard to total lipides and sphingomyelin. Cephalin decreased more rapidly and lecithin less rapidly than the sphingomyelin.

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Inhibition of anaerobic glycolysis (I), measured manometrically with slices of rabbit cerebral cortex in glucose-bicarbonate Ringer solution, began at concentrations of 20 milliequiv./l of added K ions (in isotonic solution). Concentrations of 40 milliequivs./l K^+ produced 75 per cent. inhibition of (I) in less than 10 minutes. Aerobic glycolysis was stimulated equally rapidly by addition of 30-50 milliequivs./l K^+ .

MORRIS ROCKSTEIN (Chem. Abstr.).

The Accumulation of Glycogen in the "Glycogen Body" of the Nerve Cord of the Developing Chick. Doyle, W. L., and Watterson, R. L. (Univ. of Chicago). [*J. Morphol.*, **85**, 391-403 (1949).]

The spinal cords of chick embryos were fixed in EtOH and then extracted with MeOH- $CHCl_3$ to remove cerebrosides (cf. Kerr, C. A., **31**, 424⁶).

The glycogen was determined in these dry samples by the method of Good et al. (C. A., **27**, 3496). Segments 26-29 of the chick nerve cord contained approximately 0.012 mgm. (3.2 per cent. average) of glycogen on the 10th day of incubation. This increased rapidly to 0.373 mgm. (15.7 per cent.) on the 14th day, and then at a slower rate to about 2.8 mgm. (34.4 per cent.) on hatching at 20.5 days. The value rose to 2.95 mgm. (34.5 per cent.) by 20.7 days, 3.75 mgm. (37.8 per cent) at 21.5 days, and 4.48 mgm. (42.5 per cent.) at 24.5 days. Most of the glycogen was in the glycogen body, which contained 56 per cent. of dry-lipide-free glycogen the 14th day of incubation and 76 per cent. at 21.5 days. The glycogen of the glycogen body represented approximately 5-10 per cent. of the total body glycogen from the 15th day of incubation to hatching. Unlike liver glycogen, the former was not depleted at hatching or after starvation for 24 hours after hatching. Segments of spinal cord not containing the glycogen body contained 0.2 per cent. of glycogen by dry weight.

E. K. WEISBURGER (Chem. Abstr.).

The Nature of the Golgi Apparatus. I. Parallelism Between Intercellular Myelin Figures and Golgi Apparatus in Somatic Cell. Palade, George E., and Claude, Albert (Rockefeller Inst., New York, N.Y.). [*J. Morphol.*, **85**, 35-70 (1949).]

Intracellular myelin figures were produced in a variety of fresh vertebrate somatic cells by adding ethanol in concentrations of 40-55 per cent. Isotonic solutions of sucrose appeared to delay formation of the myelin figures, while an increase in temperature or desiccation accelerated their formation. The myelin figures formed from lipide inclusions, and duplicated in morphology and topography the Golgi apparatus of corresponding cells.

II. Identification of the Golgi Apparatus with a Complex of Myelin Figures. [*Ibid.*, 71-111.]

Myelin figures were induced in cells by immersing thin discs of liver pulp in fixatives commonly used for the demonstration of the Golgi apparatus or in tissue homogenates between pH 5.8 and 5. Experiments with emulsions of phospholipide emulsions in saline solutions indicated that the droplets formed myelin figures and concentrated basic dyes. The Golgi apparatus is an artifact, namely a myelin figure or a complex of myelin figures developed in the cell during fixation and the preparation of specimens.

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Loss of Potassium from Frog Nerves in Anoxia and other Conditions. Fenn, Wallace O., and Gerschman, Rebeca (Univ. of Rochester, Rochester, N.Y.). [*J. Gen. Physiol.*, **33**, 195-203 (1950).]

The sciatic nerves from frogs in Ringer's solution lose about 23 per cent. more K in solutions equilibrated with N₂ as compared to solutions equilibrated with O₂, and apparently they tend to regain K when, after a period of anoxia, they are again oxygenated. Tying off the free ends of the nerve piece seems to increase the K loss. Likewise the K loss is increased by the addition of acetylcholine to the solution. Equilibration with 20 per cent. CO₂ in O increases the K loss in Ringer's solution, but decreases it if the nerves are in frog blood.

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Muscle and Muscular Contraction. Weber, Hans H. (Tubingen, Ger.). [*Fiat Rev. German Sci.* (1939-46), *Physiology*, Pt. III (1948), 1-42.] *Neuromuscular Conduction of Impulse.* Mercker, H. (Gottingen, Ger.). [*Ibid.*, 45-50.] *Acetylcholine.* Lullies, H. (Homburg, Ger.). [*Ibid.*, 51-92.] *Peripheral Nerve and Impulse Conduction.* Lullies, H. (Homburg, Ger.). [*Ibid.*, 93-143.] *Electrophysiology.* Schaefer, Hans (Bad-Nauheim, Ger.). [*Ibid.*, 145-67.] *Conditioned Reflexes.* Hoffmann, Paul (Freiburg i Br., Ger.). [*Ibid.*, 169-83.] *Central Nervous System.* Bethe, A., and Frank, E. [*Ibid.*, 185-94.] *Electroencephalography.* Kornmuller, A. E. (Gottingen, Ger.). [*Ibid.*, 195-216.]

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S. MORGULIS (Chem. Abstr.).

Electrical Phenomena in Nerve. (I) Squid Giant Axon. Shanes, Abraham M. [*J. Gen. Physiol.*, **33**, 57-73 (1949).]

The effects of veratrine, yohimbine, cocaine, procaine and D.D.T. have been studied. The suggestion is offered that the effects can be explained as being associated with changes in K concentration at the fiber surface, regulated by a labile permeability and metabolism.

(II) *Crab Nerve.* [*Ibid.*, 75-102.]

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M. L. C. BERNHEIM (Chem. Abstr.).

Recent Studies of Cerebral Blood Flow and Cerebral Metabolism in Man. Schmidt, Carl F., and Kety, Seymour S. [*Trans. Assoc. Am. Physicians*, **60**, 52-8 (1947).]

In schizophrenia the cerebral metabolism (measured by O_2 consumption) was normal, was not influenced by small doses of pentothal or amytal, and tended to decrease following convulsions produced by electric shock or metrazole. Cerebral metabolism was normal in severe hypertension, but tended to decrease in subjects with brain tumor, and in diabetic coma.

JOSEPH S. HEPBURN (Chem. Abstr.).

Problems of Diffusion of Small Amounts of Substance within the Human Body. Heinz, Erich. [*Biochem. Z.*, **319**, 482-92 (1949).]

A mathematical treatment of the subject. S. MORGULIS (Chem. Abstr.).

Effect of 2-Methylnaphthoquinone on the Action Potential of Nerve and Muscle. Torda, Clara, and Wolff, Harold G. [*Am. J. Physiol.*, **158**, 465-9 (1949).]

In the presence of low concentrations of 2-methylnaphthoquinone the latency and the threshold increased, and the amplitude of the action potential of nerve and muscle decreased. The muscle function on direct stimulation was not significantly impaired. Since the naphthoquinone, in the concentrations used, inhibits only the choline acetylase, the dysfunction observed suggests that acetylcholine is necessary to maintain an optimal function of nerve.

E. D. WALTER (Chem. Abstr.).

Effect of Carbon Dioxide on Brain Glucose, Lactate, Pyruvate, and Phosphates. Bain, James A., and Klein, J. Raymond. [*Am. J. Physiol.*, **158**, 478-84 (1949); cf. *C. A.*, **43**, 9202g.]

The brains of normal and convulsing cats subjected to conditions designed to alter the CO_2 -bicarbonate-carbonic acid system were analyzed after freezing with liquid air. In normal animals, breathing 10 to 30 per cent. CO_2 mixtures resulted in a lowering of lactate and pyruvate levels and had little effect on glucose or phosphate concentrations. In convulsed animals these conditions markedly limited the expected rise in lactate, pyruvate and inorganic phosphate, and prevented the fall in high-energy phosphates. There was a rise in brain glucose, but little effect on brain to plasma glucose ratios. The results are discussed with relation to possible mechanisms and the effects of CO_2 on the central nervous systems.

E. D. WALTER (Chem. Abstr.).

Potassium and Neuromuscular Transmission. Hajdu, S. (Istvan), and McDowall, R. J. S. [*Nature*, **163**, 841 (1949).]

The denervated rat diaphragm muscle preparations are more sensitive to K ion than the normal preparation stimulated through its nerve. No response to an electric stimulus is observed in a functionally denervated (curare or lack of glucose) muscle if treated with K ion (0.08 per cent. in Krebs's solution), following addition of the functional denervator. The same observation has been made on muscle with its nerve cut. Acetylcholine response remains. However, if the K ion addition precedes the functional denervator addition, then muscle response is *nil* (inexcitable by either electric or acetylcholine stimulus).

CHARLES FARMILO (Chem. Abstr.).

The Influence of the Central Nervous System on the Rest Nitrogen and the Proteins of the Blood. Fluch, Max, and Grief, Stefan. [*Z. ges. exptl. Med.*, **113**, 549-52 (1944).]

The central nervous system was stimulated by suboccipital introduction of air into the ventricles of the brain. The rest N dropped from 20 to 40 mgm. per cent. to a minimum of 10-25 mgm. per cent. after 7-24 hours and returned to normal in 48-60 hours. The total protein (normal 7-8 gm. per cent.) and the globulin fraction (normal 3-4 gm. per cent.) rose 0.5-2 gm. per cent. in 1.5 hours, then dropped 2-4 gm. per cent. to a minimum in 7-24 hours, and returned to normal in 48-60 hours. However, in some experiments the drop to a minimum did not occur. The albumin fraction exhibited minor variations.

J. H. WEISBURGER (Chem. Abstr.).

Iron Content of the Brain Tissue. (1) *Ultrafilterable and Non-Ultrafilterable Forms of Iron in Grey and White Matter of the Large Hemispheres of Dog Brain.* Dushechhina, O. Ya. [*Fiziol. Zhur. S.S.S.R.*, **35**, 284-92 (1949).]

The ultrafilterable fraction of Fe is 16 per cent. in the grey matter and 25.5 per cent. in the white matter. Average total Fe per 100 gm. raw tissue is 0.093 mgm. in grey matter and 9.44 mgm. in white matter; for dry weight these are 5.770 and 3.188 respectively. Determinations were made colorimetrically with CNS method; sample fusion was done with BaCO_3 in quartz crucibles, as Pt gave a yellowish color which interfered with the determinations.

G. M. KOSOLAPOFF (Chem. Abstr.).

Sulfur Metabolism in the Central Nervous System. Mitolo, Michele, Ruccia, Domenico, Romano, Franco, Mattia, Luisa De, and Salvatore, Addolorata. [*Boll. soc. ital. biol. sper.*, **24**, 1113-15 (1948); *Atti e relaz. accad. Pugliese sci.* (1948); *cf. C. A.*, **44**, 684g.]

Fresh central nervous system of albino rats, guinea-pigs and rabbits respectively contained on the average in mgm. per 100 gm.: total S, 195, 281, 275; inorganic S and thioconjugated S, 8, 18, 8; neutral S, 46, 144, 50; lipide S, 50, 24, 23. Administration of strychnine reduced the total S. in all 3 species by 10-20 per cent., but in the rat this reduction was highest in the protein S fraction; in the other 2 species, in the non-protein fraction. Application of ethylurethan caused an increase of total S by 21-42 per cent. in all 3 species. This increase was more marked in the protein S fraction, also in the neutral S fraction of the rat and the guinea-pig, and in the lipide S fraction of the rabbit.

F. FROMM (Chem. Abstr.).

Coccarboxylase as Catalyst of Intermediate Reactions in Nerve-Muscle Metabolism. Woker, G. [*Intern. Z. Vitaminforsch.*, **21**, 10-17 (1949).]

Coccarboxylase (thiamine pyrophosphate) combines with lecithin to form a salt which, by cleavage, gives rise to thiamine, choline pyrophosphate anhydride, and stearo-oleo-glycerophosphate. The last-mentioned compound reacts with free fatty acid to produce a glyceride and HPO_3 . Choline pyrophosphate anhydride becomes by intramolecule rearrangement, first choline pyrophosphate, then its inner ester, lastly by hydrolysis, choline pyrophosphoric acid ester. Thiamine combines with pyruvic acid to form an inner half-acetal of thiamine pyruvate; this compound reacts with H_2O to form CO_2 and the thiamine ester of decarboxylated pyruvic acid (acetaldehyde ester of thiamine). Removal of 2 H atoms, e.g. by oxidation, converts this into acetyl thiamine, which may react with the choline pyrophosphoric acid ester to form acetylcholine and regenerate coccarboxylase. Cholinesterase converts acetylcholine into AcOH and choline, which is partially demethylated and then oxidized to sarcosine. Isourea and sarcosine condense to form creatine, which reacts with adenosine triphosphate to yield phosphocreatine (phosphagen). Also choline and pyruvic acid may condense to form a half-acetal which, by loss of CO_2 , becomes acetaldehyde choline half-acetal; this, by oxidation and formation of H_2O , yields acetylcholine.

JOSEPH S. HEPBURN (Chem. Abstr.).

Pyrophosphatase Activity of Brain Tissue. Gordon, J. J. [*Nature*, **164**, 579-80 (1949).]

Fresh rat brain was converted to a dry powder by the method of Fleischhacker (*C. A.*, **33**, 7825¹). Suspensions were incubated with pyrophosphate, and the liberation of orthophosphate was determined colorimetrically. Maximum pyrophosphatase activity was seen in the range pH 6.8-7.4, at a substrate concentration of 0.0005 M, and in the presence of 0.02 M MgCl_2 . The enzyme was destroyed by heating for 0.5 hour in boiling water, and was strongly inhibited by CaCl_2 , CuSO_4 , alloxan, and Na iodoacetate. The brain system appears to be similar to that reported in erythrocytes (Naganna and Menon, *C. A.*, **42**, 7354ⁱ), and both probably contain active thiol groups.

FRED H. SNYDER (Chem. Abstr.).

Influence of Ingestion of Quinine Salts on the Electrical Activity of the Cerebral Cortex in Man. Gallouin, L., and Lemaire, R. [*Compt. rend. soc. biol.*, **143**, 436-7 (1949).]

Ingestion of 1-1.5 gm. of quinine sulfate causes an increase in the duration of the individual α -waves of the electroencephalogram, without change in frequency.
L. E. GILSON (Chem. Abstr.).

Site of Action in the Central Nervous System of a Bacterial Pyrogen. Chambers, W. W., Koenig, H., Koenig, R., and Windle, W. F. [*Am. J. Physiol.*, **159**, 209-16 (1949).]

The response to injection of purified pyrogenic extract of a *Pseudomonas* species was studied in cats and dogs, both intact and with central nervous system lesions. The febrile response to the pyrogen was mediated through the central nervous system, and the spinal cord needed to be in functional communication with one or more centers in the brain.
E. D. WALTER (Chem. Abstr.).

Role of the Sympathetic Nervous System in the Metabolism of Adrenaline During Muscle Irritation under Various Conditions. Utevsii, A. M., and Butom, M. L. [*Biokhimiya*, **14**, 452-9 (1949); cf. *C. A.*, **42**, 8918b.]

Sympathetic nerve impulses in the frog cause the disappearance in muscle tissue of the reversibly oxidized form of adrenaline (dehydroadrenaline), and its reduction to adrenaline; bound adrenaline is also liberated in the process. These changes are unaffected by curare, but the effects are cancelled by ergotamine. Motor nerve impulses are without influence on the adrenaline-dehydroadrenaline systems and on bound adrenaline.
H. PRIESTLEY (Chem. Abstr.).

Metabolism of Dogs During Intoxication from Agerized White Wheat Flour. Monahan, E. P., and Lalanne, G. G. [*Am. J. Physiol.*, **159**, 298-302 (1949).]

The metabolism of 6 dogs was studied to determine what changes occur in conjunction with intoxication from the ingestion of agerized white wheat flour. There was a large increase in serum acetylcholine and a striking decrease in serum cholinesterase activity during intoxication. These changes were progressive, being greatest toward the end of the period of intoxication. No impairment of kidney or liver function was detected. No consistent or biologically significant changes occurred in blood chemistry and urinary excretion products during the course of intoxication.
E. D. WALTER (Chem. Abstr.).

Distribution of Certain Enzymes in the Brain of the Pigeon. Sinden, Jo Ann, and Scharver, Ernst. [*Proc. Soc. Exptl. Biol. Med.*, **72**, 60-2 (1949).]

Results of histochemical tests for alkaline and acid phosphatase, phosphamidase and cholinesterase on various parts of the pigeon brain are described. There are marked differences in the enzyme contents of various structures of the brain.

L. E. GILSON (Chem. Abstr.).

Bifrontal Lobotomy for the Relief of Organic Pain. LeFever, Harry E. [*Ohio St. med. J.*, **45**, 128-130 (1949).]

Bifrontal lobotomy has been found successful as a surgical procedure for the relief of certain mental disorders. A major psychological result of the operation is an indifference to situations for which the patient was previously highly concerned. Hallucinations may continue, but the patient is no longer bothered by them. It became evident that the extreme pain associated with certain non-curable diseases might be diminished by bifrontal lobotomy. The first operation (for pain relief) was done in 1945 by Von Wagenen. The operation (unpublished) completely relieved a painful phantom arm that had resisted other treatments. Five further cases of operation for relief of organic and psychic pain are described.

G. W. KNOX (Psychol. Abstr.).

2. Pharmacology and Treatment.

Certain Actions of Curare on the Central Nervous System. McCawley, E. L. [*J. Pharmacol. Exptl. Therap.*, **97**, 129-39 (1949).]

In experimental animals purified curare, d-tubocurarine chloride and intoastrin can, with rapid intravenous injection and the absence of anesthetics or narcotics, induce central nervous system stimulation as shown by clonic convulsions and a typical spike discharge in the electroencephalogram. This action is prevented by central depressant drugs. Large doses of curare cause an irreversible depression of the central nervous system, which is unaffected by anticurare agents but is reversed temporarily by metrazole. When synaptic transmission is measured in a ventral root after stimulation of the dorsal root, curare produces a block of internuncial neurone activity and finally the two-neurone arc discharges disappear.

L. E. GILSON (Chem. Abstr.).

Curare. Its Pharmacology and its Use as an Adjunct to Convulsive Shock Therapy. Kuitert, John H. [*Arch. Phys. Med.*, **26**, 99-104 (1945).]

Discussion with 22 references.

E. K. WEISBURGER (Chem. Abstr.).

Narcosis of Dogs with Polamidone. Berge, E., and Muller, H. (*Justus Liebig Hochschule, Giessen, Ger.*). [*Tierärztl. Umschau*, **4**, 372-7 (1949).]

Polamidone is 2-dimethylamino-4,4-diphenyl-5-heptanone-HCl. A dose of 2 to 3 mgm. per kgm. body weight, injected intravenously within $\frac{1}{2}$ to 1 minute, gives safe and long-lasting narcosis which is free of side reactions.

R. SEIDEN (Chem. Abstr.).

The Pressor and Depressor Effects of Certain Sympathomimetic Amines. Wislicki, Leo. [*Brit. J. Pharmacol.*, **4**, 304-7 (1949).]

Amphetamine (I) and its d-isomer (II) are equally potent in their effects on blood pressure of anesthetized or spinal cats. Ephedrine (III) differs from (I), (II), and methyl-(I) in that on repeated doses (III) does not cause a depressor response. The various amines are interchangeable in blocking the pressor effect; thus, methyl-(I) may give a depressor response when given after fair doses of (I), (II), or methyl-(I), none of these effects being influenced by atropine. The pressor effect of adrenaline persists independently of changes in the action of the other amines.

RICHARD F. RILEY (Chem. Abstr.).

Antisymphathetic Action of Sympathomimetic Amines. Åström, A. [*Acta Physiol. Scand.*, **18**, 295-307 (1949).]

A group of sympathomimetic amines was investigated from the point of view of their ability to antagonize the inhibition produced by adrenaline, l-nor-adrenaline, or by electric stimulation of the mesenteric nerves. The experiments were made on isolated strips of rabbit intestine. The 14 amines were separated into 3 classes (adrenaline, ephedrine, and tyramine). The antisymphathetic property of ephedrine or l-N-ethylephedrine is rather common to sympathomimetic amines, with the exception of such dihydroxyphenyl substitutes as adrenaline, arterenol and aleudrine. Whatever antisymphathetic action has been observed with adrenaline or aleudrine is thought to result from some oxidation product of these substances. Ephedrine, both d- or l-, and benzedrine have practically the same effect on the intestine and have a similar antisymphathetic action. It is generally believed that sympathomimetic amines act directly upon the cell, but it is also suggested the action may be through an inhibition of the amine oxidase. These experiments seem to support the interpretation that all the amines studied act directly upon the effector cells.

S. MORGULIS (Chem. Abstr.).

Influence of Nicotinic Acid and Riboflavin on Metrazole Shock. Calabro, Q., and Savini, R. (*Univ. Perugia, Italy*). [*Boll. soc. ital. biol. sper.*, **24**, 823-4 (1948); cf. preceding abstract.].

A convulsion was caused in normal dogs by 0.8 c.c./5 kgm. of 10 per cent. metrazole (I). After injection of 90-150 mgm. nicotinic acid (II) and 5 mgm.

riboflavin (III) the convulsion was produced by 0.2–0.3 c.c. (I). Injection of (II) and (III) into the spinal fluid made the shock by (I) more violent and let it last longer.
F. FROMM (Chem. Abstr.).

The Effect of Hypophysectomy on Resistance to Narcotics. Soo, Chung Chang. [J. Korean Med. Assoc., **1**, No. 1, 53 (1948).]

The resistance to MgSO_4 and chloral hydrate was decreased 24 hours after hypophysectomy.
I. S. YUN (Chem. Abstr.).

Antiepileptics. Hazard, Rene, and Cheymol, Jean (Faculté Med., Paris). [J. Pharm. Pharmacol., **2**, 1–9 (1950).]

A review (in French) of the chemotherapeutic agents. The relation between molecule constitution and pharmacological action is discussed.

S. W. GOLDSTEIN (Chem. Abstr.).

Effect of 3-(o-Tcloxy)-1,2-Propanediol (Tolserol, Myanesin) on the Electrograms of Human Cortex and Subcortex. Spiegel, E. A., and Wycis, H. T. (Temple Univ. Med. School, Philadelphia, Pa.). [Proc. Soc. Exptl. Biol. Med., **72**, 446–8 (1949).]

Tracings and description.

L. E. GILSON (Chem. Abstr.).

Effect of Various Concentrations of Alcohol on Sorptive Power of Cells of Sympathetic and Animal Nervous Systems. Romanov, S. N. (Inst. Exptl. Med. Acad. Med. Sci. U.S.S.R.). [Doklady Akad. Nauk S.S.S.R., **69**, 473–6 (1949).]

In vitro experiments with dissected specimens of rabbit nervous system in neutral red solutions showed that the absorption of the dye has a minimum at 4 per cent. EtOH concentration, rises to a plateau at 10–14 per cent., and rises sharply up to 22 per cent. EtOH concentration in sympathetic ganglia. The sensory ganglia give a similar curve, displaced by 6 per cent. to the higher EtOH concentrations. Immersion for 5 minutes in 5 per cent. EtOH lowers absorption on subsequent immersions in higher concentrations, indicating a protective mechanism of the tissues.

G. M. KOŠOLAPOFF (Chem. Abstr.).

Blood Cholinesterase and Narcosis, with Special Reference to Sodium Pentothal. Brilliante, Felice (Univ. Bologna, Italy). [Boll. soc. ital. biol. sper., **24**, 915–17 (1948).]

Cholinesterase (I) in the femoral blood of dogs first decreased in pentothal narcosis reached a minimum 15 minutes after the beginning of treatment and returned to normal or higher 15 minutes later. The increase of (I) to values above normal continued after discontinuation of narcosis. The changes of (I) are parallel to those seen in the same dogs in narcosis with CHCl_3 , Et_2O , or evipal.

F. FROMM (Chem. Abstr.).

Electroencephalograms in Narcosis by Barbiturates. Colombati, S., and Alema, G. (Univ. Bologna, Italy). [Boll. soc. ital. biol. sper., **24**, 903–4 (1948), cf. A. Riv. neurol., Dec., 1947.]

The electroencephalogram of 14 patients in slight narcosis by 0.4–0.6 gm. narcovene S (Na salt of isopropylbromoallyl-N-methylmalonylurea) was similar to that in narcosis by Na pentothal (cf. Brazier and Finesinger, C. A., **39**, 1466*).

F. FROMM (Chem. Abstr.).

The Pharmacological Action of 2-Phenylisopropylamine on the Nervous System. I. The Action of Cortical Excitability and Subordination Chronaxia of the Bulbopontinic Motor Neurones. Scarinci, V. (Univ. Bologna, Italy). [Boll. soc. ital. biol. sper., **24**, 887–90 (1948).]

II. Action on the Variation of Subordination of Encephalic Nerves, Produced by Strychnine. [Ibid., 890–2.]

See C. A., **44**, 740d.

F. FROMM (Chem. Abstr.).

Synaptic Blocking Agents. (I) *Technique of Assay of Products Active in Parkinsonism.* Longo, V. G., and Bovet, D. [*Farm. sci. e tec. (Pavia)*, **4**, 515-25 (1949).]

Injections of 1 mgm./kgm. of nicotine tartrate into the ear vein produce dyspnoea, inability to remain upright, and body tremors which are accentuated in the extremities. The substance to be tested for ability to prevent these tremors is given intravenously 5 minutes preceding the nicotine. In another test nicotine is injected in increasing dosage up to temporary heart arrest (0.4 to 0.6 mgm./kgm.), and after one hour the test substance is injected, followed by the same dose of nicotine, which now must not produce any alterations in an electrocardiogram. Diparcol and parpanit show high activity lasting for about one hour. Trasentinal, benzedrine, benadryl, and procaine, which have central nervous action beneficial in Parkinsonism, but not related to their spasmolytic, sympathomimetic, anti-histaminic, or analgesic action, also show a moderate effect of shorter duration. Et₄NI has a fleeting effect at high dosage. Atropine and scopolamine have no effect, showing a difference in mode of action. Some N-substituted phenothiazine derivatives were tested; they were 3356 R.P. (CH₂CHMeNEt₂ derivative) (I), phenergan (II), and 3015 R.P. (CH₂CH₂NMe₂ derivative) (III). (I) was most active, providing some protection for 3 hours; (II) was active for one hour, and (III) had no activity. The results were in accord with clinical observations.

A. E. MEYER (Chem. Abstr.).

Efficacy of Peripheral-acting Drugs in the Treatment of Experimental Spasticity. Hajek, Norma P., and Hines, H. M. [*Arch. Phys. Med.*, **30**, 517-22 (1949).]

Rats were injected in one leg with sufficient tetanus toxin to produce shortening and rigidity in one limb, but not in the contralateral limb, which served as a control. Injection of curare or neostigmine produced some relaxation, but did not bring about sufficient elongation of the shortened muscle or prevent or lessen the atrophy and loss of strength. A 5 per cent. solution of NH₄Cl was given 3 times daily by gavage, without any effect on the spasticity, the atrophy and the loss of strength.

E. K. WEISBURGER (Chem. Abstr.).

Therapeutic Concentrations of Penicillin in the Cerebrospinal Fluid Following Parenteral Penicillin and Oral Caronamide. Boger, Wm. P., Baker, Richard M., and Wilson, Wm. W. [*Trans. Am. Neurol. Assoc.*, **73**, 105-7 (1948).]

Penicillin appeared in the cerebrospinal fluid of 18 of 23 patients with paresis after 5 days of treatment with 100,000 units penicillin every 3 hours intramuscularly, and of 20 of 25 patients receiving for 5 days the same injections + 3 gm. caronamide orally every 3 hours. Concentrations attained in the 2 groups were 0.019-0.052 and 0.052-2.5 units/c.c. respectively. Plasma concentrations of penicillin were also higher in the second group.

MARION HORN PESKIN (Chem. Abstr.).

Chemical Pharmacological Antagonism Between Picrotoxin and Barbiturates. Garcia, Wenceslao Tejeda. [*Rev. facultad farm. y bioquim., Univ. nacl. mayor San Marcos (Lima, Peru)*, **10**, 282-92 (1948).]

The minimum lethal dose in rabbits is for phenobarbital 150 mgm. per kgm., pentobarbital 130 mgm., pentothal 80 mgm., for picrotoxin (I) 1.2 mgm. (I) counteracts the depressant effect of the barbiturates on respiration. The antidotic balance for one part (I) is 26.6 to 32 parts barbiturates. The dose of (I) given to save the life in barbiturate intoxication would be fatal in a normal animal. The antidotal effect appears between 2 and 24 hours.

A. E. MEYER (Chem. Abstr.).

Post-Stilbamidine Neuropathy, with Reference to Retention of the Drug in the Body. Sati, Mohammed Hamad. [*Ann. Trop. Med. Parasitol.*, **43**, 4-12 (1949).]

A number of kala-azar patients who had been treated with fresh solutions of stilbamidine (I) and had recovered were examined for neuropathy symptoms and urinary excretion of (I). Forty-one out of 45 such cases showed symptoms, chiefly related to neuropathy of the trigeminal, cervical, upper dorsal, 7th and 9th cranial nerves. Symptoms appeared in 1 to 13 months, usually 6 months, and

disappeared in 2 years. Urinary analysis for fluorescent material (cf. Henry and Grindley, *C. A.*, **40**, 618^a) showed the excretion of 13-146 γ /100 c.c. of (I) in 31 cases showing neuropathy. This excretion was present as late as 3 years after cessation of therapy. The effects of light on the stored (I) and their relation to the neuropathy are discussed.

CARTER D. JOHNSTON (Chem. Abstr.).

Effect of Acridine Compounds on the Respiration of the Brain of the Six-day Chick Embryo. O'Connor, R. J. [*Nature*, **163**, 405 (1949); cf. *C. A.*, **43**, 7135g; *Albert and Marshall, C. A.*, **42**, 7366e.]

Exposure of the isolated brain tissue to the acridine compound resulted, within 2 hours, in pycnosis (swelling and fusion of chromosome in dividing cells). The results were obtained by a micromanometric method and are interpolations from curves relating inhibition of O₂ consumption to concentration. The following acridines were studied: 9-amino-acridine-HCl (*C. A.* numbering), 9-amino-4-phenyl-10-methylacridinium bromide, 9-amino-10-methylacridinium bromide, 9-amino-3-trifluoromethyl-acridine-HCl.

CHARLES FARMILLO (Chem. Abstr.).

Effect of Amphetamine on the Synaptic Transmission of Sympathetic Ganglia and Spinal Cord. Luco, J. V., Martorell, R., and Reid, A. [*J. Pharmacol. Exptl. Therap.*, **97**, 171-6 (1949); cf. *C. A.*, **42**, 7435b.]

In cats anesthetized with nembutal amphetamine (I) in small doses had a potentiating effect on the response of the sympathetic (stellate) ganglion, but in large doses it was depressant. Tachyphylaxis did not occur. The effect of (I) on the spinal reflex was studied in cats anesthetized with dial, and in decerebrate cats. With submaximal and maximal stimuli small doses of (I) potentiated the monosynaptic response and large doses depressed the response. The action of (I) is partially antagonized by barbiturates.

L. E. GILSON (Chem. Abstr.).

Epilepsy Treatment with Citrullamon. Rauch, Hans Joachim, and Elsken, Bernhard. [*Arztl. Wochschr.*, **3**, 631-4 (1948).]

Citrullamon V, C(O)CPh₂NHC(O)N(CH₂)₃-CH(NH₂)CO₂H, is prepared through the condensation of benzil with α -amino-ureidovaleric acid. It does not have the hypnotic effects of luminal and is less toxic than sodium diphenylhydantoin.

W. T. SMITH, Jr. (Chem. Abstr.).

Modified Ultraviolet Spectrophotometric Method for Determination of Barbiturates. Gould, T. C., and Hine, C. H. [*J. Lab. Clin. Med.*, **34**, 1462-70 (1949).]

The barbiturates are directly extracted with Et₂O from as little as 1 ml. of serum in a semimicro continuous extraction apparatus. The solvent is evaporated and the residue is brought into solution as the Na salt by means of a borate buffer, pH 9.5. The optical d. of the solution is determined at 225, 240, and 265 m μ on a Beckman DU spectrophotometer, and the amount of drug is calculated by means of a standard curve prepared by a method which eliminates blank serum interference. This procedure gives recoveries ranging from 92-101 per cent. The formula for calculation by "base-line method" is described and its advantages discussed. Salicylates interfere, but sulfonamide compounds do not.

BERNARD KLEIN (Chem. Abstr.).